A TREATISE

ON

THE BREAST,

AND ITS SURGICAL DISEASES.

BY

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PREFACE TO FIRST EDITION.

The following Treatise on the Breast and its Surgical Diseases, was written for the *American Journal of Homœopathic Materia Medica*, and appeared in part in the closing numbers of that periodical, which were issued May, June, July and August, eighteen hundred and seventy-six. The consolidation of the *American Journal of Homœopathic Materia Medica* with the *Hahnemannian Monthly*, was consummated in December of the same year, and necessitated a change in the method of publishing this Treatise. Without altering the original plan of the work, the serial character of which excluded much valuable material, it is offered to the profession in its present form.

New York, 1877.

PREFACE TO THE SECOND EDITION.

Since the publication in 1877 of the first edition of this Treatise so much has been added to the knowledge of physiological and pathological histology, that it was found necessary to remodel the second edition.

The principal changes made relate to the ætiology of neoplasms and are based upon the permanence of blastodermic differentiation, and the broad hypothesis, that all morbid processes have their genesis in normal processes ; that pathological new formations obey in their construction the same laws that pertain to the physiological building up of tissues.

Emphasizing this theory of the ætiology of mammary neoplasms, has led to changes in their classification, and in some instances, in their nomenclature.

New York, January, 1885.

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PART I.

GLANDS IN GENERAL.

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The system upon which organized bodies are constructed, and by which they exist, requires that they not only prepare food for their own maintenance, but also for the maintenance of some other organisms, more or less remotely situated, in the scale of life. For, while it is true that the appropriate food for an organism contains all, and more, than is required for nourishment, it is known, that frequently this food is not in a form to be assimilated by the tissues it is intended to construct and maintain; that it must be broken up, and lose its characteristic form, before it can be made available for food. And further, the surplus that is derived, either from the material received into the system, or is the chemical result of the expenditure of force,—organic activity,—being injurious, in some instances, positively poisonous, is thrown out of the system, as waste material to the organism from which it comes, but as nourishment to some other organism, into which it is received, and again elaborated, it may be in another form, to once more serve as food. Mutual dependence pervades all life, no single individual, or group of individuals, can exist alone. If the demonstration is carried to the simplest form of life, the nucleated cell, and this is truly an individual, it is found that, either from an inherent necessity to multiply, or because really dependent upon the conditions which other cells, of a different variety engender, cells never exist alone,

but are constantly associated with similar cells, or those belonging to another genetic group. To this principle of multiplication, which also includes that of mutual dependence, are the laws of the building up of tissues, subservient, for the sequence of the appearance of individuals in the scale of life, and of tissues and organs in the individual organism, follows no other apparent law, than that which gives an individual the power to prepare a nourishing medium for the development of some other or similar individual. All organic life is thus brought within the scope of this great law of development. The distinctly marked periods of evolution, each depends upon the preparation made by the preceding epoch, and is made necessary by the very conditions and office of that period. The principle enunciated, is true equally of physiological and pathological processes. In health, each part acts within the limit of its function, that is, does not encroach upon the active sphere of any other part, nor throw upon that part work that it is not fitted to perform. In disease, the opposite obtains, there is undue activity, or reduced activity, either of which states, may, by assimilating too much, or not enough, induce such a condition of the nutrition media, as to interfere with nourishment, and hence with growth and development. This is strikingly illustrated in pathological formations, which find their prototypes in healthy histological elements, the pathological process representing either an excessive or diminished action of some other part than that which is diseased. Thus may it not be said, that each form of life, and why should this be limited to organic nature, from the lowest to the highest, now within the scope of scientific investigation, prepares food for some other form of life; that each cell, or collection of cells, and this includes organs and organized bodies, furnishes material necessary for the support of other bodies, and without which material these bodies would not appear.

Secretion is performed by cells that possess the property of separating from the blood or other circulating fluid, certain materials, either not in a form or a position to be available as food. Secretion is accomplished when the cell wall

is brought in contact with the blood, for peculiar constituents of which, the cell nucleus has an affinity. The nucleus, therefore, which is the life of the cell, is also the active agent in secretion, but when it has drawn to itself all the material that the cell will contain, and possibly rearranged the constituents of that material, it probably dies, the cell bursting and discharging its contents, This contents of the cell henceforth becomes the secretion, and to collect this secretion in the position most available, reservoirs are formed in various parts of the body.

Aside from the office they perform, these reservoirs or glands, are structurally distinguishable from all other tissues, for in whatever form anatomy may require the organ to be moulded, there is constantly present a membrana propria or basement membrane, on one side of which rests a layer of secreting epithelial cells, on the other side, a minute ramification of blood vessels. This is absolutely all that is required to form a secreting apparatus. It is believed that secretion may take place without even a circulation, if the nervous system remains intact.

The development of glands begins with the segmentation of the ovum, from which process, finally results two primitive layers, the *epiblast*, externally, and the *hypoblast*, internally, with later, a middle layer, the *mesoblast*. The *epiblast* and *hypoblast*, which represent a diploblastic condition, do not differ appreciably in their time of origin, but the appearance of the *mesoblast*, which constitutes a triploblastic state, and is formed either from the *hypoblastic* layer, or possibly in some instances from indifferent cells, which bud off in the substance found between the two primitive layers, is not developed until the *epiblast* and *hypoblast* are completely formed, the actual period varying with the species of animal examined.

Each of the three germinal layers is associated with the development of glands, but the secreting cells are probably in general derived from the *hypoblast* ; this is true of the liver, pancreas, thyroid body, and the smaller glands of the alimentary canal, but the mouth being lined by *epiblastic* cells, probably the secreting cells of the salivary glands

are derived from the outermost germinal layer. This layer also gives origin to the accessory—therefore the mammary gland. From the *mesoblast* are derived the endothelial cells of the generative and urinary glands, though this layer is mainly instrumental in giving origin to bone, muscle, connective tissue, and the circulating organs. While, therefore, each of the germinal layers is capable of giving rise to secreting cells, the majority of glands are derived from the inner or *hypoblastic* layer, but the law of development seems to be that the secreting bodies are descendants of the epithelial cells of the *epiblast* or the *hypobtast*, according as one or the other of these layers enter into the construction of the part of the organism in which the individual gland is situated. These cells are the active agents in secretion, and in them the impulse to construct an organ that shall differ in function from the surrounding epithelial cells and connective tissue, originates.

The development of glands is said to begin with a prolif eration of the epithelial cells of the spot in the organism where the gland is to be formed. This multiplication of cells continues, until a solid growth is formed, which projects inwards, impinging upon the cellular tissue that lies under the epithelial layer. The process of sacculation, a later stage in the development of glands, probably begins while the growth is small, compared with its full size, and is the first indication of functional activity that the gland shows. At a certain time cells in the center of the solid growth take from the blood, and elaborate, their peculiar pabulum, these cells when ripe to discharge their secretion, being enlarged, and possessing the power of communicating their activity to contiguous cells, pass in the direction of the least resistance, which is toward the surface from which the gland developed. Thus is formed a communication between the interior of the gland and the external parts, and at the same time a sac, having the requirements of glandular tissue, that is, lined with secreting cells, and defined by a basement membrane, upon the outer side of which bloodvessels lie. It is difficult to say whether the vascular disposition begins with the prolification of the

epithelial cells, or acts as a stimulus to the functional activity of the cells, and therefore does not exist until the solid growth is formed, and is ready to take on the process of sacculation, but the entire development being under the control of the nervous system, and taking place in accordance with the laws of biology, it is probable that each tissue involved in the formation of glands at the time when its presence is necessary in the growth of the organ, receives its impulse to develop in accordance with the formative law of the organism, and of the peculiar part to be developed.

The conformation of glands seems to have no other object than that of convenience and utility. It has not been possible to establish any connection between the shape of the organ and the character or the quantity of the secretion. In the economy of the organism, a gland becomes necessary in a certain situation, and hence its shape must in no wise conflict with other equally necessary organs with which it is in close contact. If the quantity of secretion required is large, and the unobstructed space small, the gland will be found to have many ramifications, connected by narrow tubes, which run between muscles and vessels: thus is gained a large secreting surface. Exactly as the sacculation of the solid growth proceeds in the direction of the least resistance, so the form of the gland is determined by the muscle nerves and vessels, in the region of its development.

Agreeable with the laws of glandular conformation, there are found: First, Secreting organs when the surface is augmented by the basement membrane rising and forming a protrusion. Instances of this exist in the Haversim fringes of the synovial membranes, the choroid plexuses in the brain, and the ciliary processes in the eye-ball. Second, Secreting organs in which the surface is augmented by the basement membrane forming a recess, this constructive system includes the majority of glands. The first degree of glandular inversion is represented by a single sac—*crypt, follicle lacuna*—examples are found in the stomach, intestines and uterus. It is probable that from this simple

follicle the more complicated glands are formed by a process of development; this is agreeable with the recognized laws of evolution, for it is known that when any particular gland appears in the animal series, it is invariably of the simplest glandular formation, and that in the higher classes a gland corresponding in function to this, may attain the most intricate structure; as an example, the salivary glands of birds are of the simplest construction, so also the pancreas of fishes, and the liver of insects. These glands, as they appear in the higher organisms, are built upon a much more complicated anatomical system.

The secreting surface of the simple gland is increased by lengthening of the tube, but should this be excessive, the pressure of adjacent organs would compress its walls; hence the tube at its distal end becomes coiled into a ball; sweat glands are so formed. The simple gland is further and more frequently evolved, by a subdivision and extension of its cavity, the sac or tube becomes pouched along its extent or at its extremity, and these pouches pass through a formative cycle, similar to that by which the gland primarily became inverted. These pouches increase at the expense of the surrounding cellular tissue, though there is no reason to believe that they are formed from its cells, there is, however, an intimate relation established between the covering of the pouch and vessels running through the cellular tissue in which the gland is developed.

The impulse to the formation of a compound gland, is subject to the same systemic demand for increased secretion, but histologically resides in the epithelial cell. These demands recurring through nervous agency, and the cells receiving through the blood, the peculiar pabulum which makes multiplication possible, accumulate at a certain point in the tube or sac. The spot at which this aggregation of cells takes place does not seem to be constant, for there has been no regularity observed in the division of glands, possibly the temporary pressure of a muscle, causing slight obstruction to the flow of secretion, results in stagnation of gland cells, and hence multiplication at that spot, or possibly a thinness of the basement membrane, gives rise to

less resistance to the pressure from within, and so a depression favors a collection of gland cells. The accumulation of cells increasing by pressure causes a bulging outwards of the membrana propria, and the bulging forms an actual inversion. During the process of inversion, when the division of the gland is first recognized as a separate part, the newly formed sac is probably solid, composed of a mass of epithelial cells. This mass, by the process of sacculation already referred to, finally becomes an independent secreting organ, connected with other parts of the same gland, by only a tube or duct, through which its secretion flows.

According to the form that the divisions of a compound gland, assumes the gland as a whole is called *tubular*, *sacular* or *racemose*. The former two have been described. A racemose gland, beginning as a simple sac, by a process of inversion, and vacuolation, divides and subdivides, until the original tube has processes extending in various directions. Each one of these processes, after becoming a separate secreting organ, also begins a process of budding, and this in turn goes through a similar development, and so on, only limited by the requirements of the organism. A portion, however, of the original tube remains, to constitute the general excretory duct, through which the secretion is poured upon the tissue from which the gland was inverted. What is true of the primary inversion, also applies to each one of the vesicular recesses, of which the gland is composed, a certain portion of the inversion remains, and possibly in some instances becoming constricted near the point of bulging, forms a canal through which the disengaged cellular elements of the secreting portion are thrown out. The method by which the secretion is conveyed from the ultimate saccules or alveoli of a racemose gland, is probably a modification of that which obtains in the system of ducts. These minute parts of the gland, have but a small central cavity, possibly in some instances none, in which takes place the epithelial metamorphosis of secretion. When this absence of vaccuolation obtains, there exist exceedingly small canals, which pass

between the gland cells, from which they are not separated by a limitary membrane. The shape and direction of these canals, therefore, is constantly subject to changes, which originate in the motion of the secreting cells. This anatomical arrangement possesses a peculiar pathological interest, for probably many glandular diseases have their starting point in the smaller portions of the gland, and are caused by obstructions to the flow of the secreted fluid, which obstruction, in turn, depends upon such a crowding of cellular elements, as to close the minute excretory canals.

Though the majority of glands are provided with ducts, these are not essential to a secreting—glandular—organ. The lymphatic ganglions, possess a perfect and somewhat complicated secreting apparatus and beyond doubt change the lymph that enters their substance, but unless the lymphatic vessels are considered ducts, the glands are ductless.

The solitary closed follicles of the intestines, the thyroid body, thymus gland, and suprarenal capsules, are all glandular in structure, and so far as their several functions are known, perform the office of glands in relation to the organism, but the product of their secretion is taken up directly by the circulation, and does first pass through ducts.

The line would seem to be an arbitrary one, that establishes a distinction between glandular and non-glandular organs, upon the method of disposing of their secretion ; it is indeed difficult to understand why an organ that purifies blood or a fluid carried to it, and returns this to the circulation by whatever means the economy of nature demands, is not a similar organ, at least in function, to one that removes from the system, properties not adapted for nutritive purposes.

The formation of ductless or vascular glands, probably differs from that believed to obtain in the development of glands, provided with an excretory canal. The latter, proceeding from, retain their communication with the surface of the body ; the former, though in a few instances, as the

thyroid body, which either originates as a depression, in which case the communication becomes constricted, or as a prolification of the inner layer of epithelial cells, in the majority of instances develope in the connective tissue as a vacuolation of endothelial cells. In this manner the vascular system, which also has been made to embrace the lymphatic system, developes, and between the vascular system and those glands that have no other means of discharging their contents, than directly into the circulation, there is probably some analogy of formation. Among glands, belong also the testicles and ovaries, the sperm, and the germ producing organs, but they differ essentially from other secreting organs. They are developed from special embryonic bodies, the Wolffian bodies, and the nature of their secretion is unlike that of other glands in this, that while in other glands, the discharge of their secretion involves the distruction of the gland cell, the germ and the sperm cells, developed as they are from epithelial cells, are discharged as nucleated cells, or independent units, whose function is not to support life, either directly or indirectly, but to continue forms of life, to establish independent organisms.

We must not, however, fall into the error of regarding the reproductive cells as highly organized bodies, they appear rather to be of the simplest construction, to be cells that have not passed to a complicated developement. "Among many inferior animals devoid of special reproductive organs, such as the *Hydra*, the ova and spermatozoa originate in the layer of indifferent tissue that lies between the endoderm and the ectoderm ; that is, they consist of portions of the least specialized substance. And in the higher animals, these same generative agents appear to be merely modified epithelium cells—cells not remarkable for their complexity of structure, but rather for their simplicity." (Spencer.)

As these cells have departed but slightly from the original and primitive type, even their "motive appliances being interpretable, not as intrinsic, but as extrinsic modifications that have reference to nothing beyond certain mechanical

requirements;" may we not assume that the glands, which in the higher organisms are set apart for the production of the generative cells, perform their office by preventing a higher differentiation of individual elements, and retaining the constructive powers of undifferentiated blastema, which has possibly to do with a spermatic influence.

The structure of glands differs somewhat with their external conformation. Thus in racemose glands, considering the secreting aparatus as a whole, there is a varying quantity of solid matter consisting of connective tissue, or corpuscles and amorphous matter, lying between the ducts and divisions of the gland, binding them together into a firm compact mass. Again, some glands, as the testicles, kidneys, and prostate gland, possess a special envelope of firm and dense fibrous tissue, but these peculiar arrangements exist to adapt the gland to perform a special function in a special location, the constant glandular structure consists of secreting cells, a basement membrane, bloodvessels, lymphatics and nerves.

The secreting cell, agreeable to the requirements of surrounding parts, which may exercise pressure upon the gland, or the method of discharging the secretion, assumes a sphoroidal, polyhedral, or columnar shape. That the character of the secretion has at least, in some instances no influence to determine the shape of the gland cell, is evident from the observation made upon the liver of mollusca; here some cells contain fat, while others of the same shape are filled with biliary matter. The relation between the function of cells and their shape, is a subject that at present does not admit of satisfactory study, but viewing nature, even in its ultimate manifestations, as an adaptation of forms to uses, it is not to be believed that the shape of cells is accidental, or that no laws exist to determine their conformation. The pressure upon gland cells, and their situation in the secreting apparatus, are instrumental in giving them external form, but it is probable that every variety of gland cell does not form a part of secretion, that only certain forms are fitted to be thrown off from the basement membrane. Assuming that this is

true, the nourishment of the cell becomes a cause of its change in shape. Change of form is one mode of motion, and in the cells that constitute the protoplasmic masses of lower animal life, the stimulus to a change of position resides in the particular food required by the cell ; the similarity between all cell life strengthens the conclusion that at least gland cells change their form to obtain nourishment ; and to yield the secreted fluid in those cases where the function of secretion does not involve destruction of cells ; for it has been observed, that previous to discharging their contents, some cells become elongated in the direction of the duct of the gland.

The epithelial cells that line the ducts of glands are usually polyhedral or spheroidal at the beginning of the duct, but pass into the columnar shape in the rest of its length. In the uterine glands, which in the human species are generally simple convoluted tubes, the epithelium has been demonstrated by Friedländer and Williams to be ciliated, also the epithelium lining the *vas efferentia*, *coni vasculosi*, and first part of the excretory duct of the testicle, and the excretory ducts of some small racemose glands. It is probable that when ciliated epithelium exists, the peculiar motion of these cells favors the discharge of the gland secretion.

If we would include all varieties of histogenetic life, the term cell should be less restricted in its application, for it is certain that minute masses of living matter exist that possess neither nucleus nor investing membrane, and whether we consider the embryonal cell as an ideal type, or as marking a primitive cell formation, in these cells are observed the highest degree of formative power, and they consist of a mass of bioplasm and a nucleus. A wall may form, but this is at the expense of the outer layer of bioplasm ; usually there exists no wall, the mass is separated from surrounding tissue by not combining with it. It has, however, been observed, that in the less permanent cell types the nucleus disappears, and that those masses of bioplasms that in their life cycle are subjected to influences possibly detrimental to their persistence, there exists a wall, or

investing membrane; we may therefore, upon a physiological basis, take as the typical cell a mass of bioplasm, and regard the nucleation and walling of that mass as phases in the development and necessities of the cell. The epithelial cells of glands, like other epithelial cells, are usually nucleated and provided with a wall, but when the gland is functionally active the cells resemble embryonal cells in possessing no wall, or appear as large granular cells, and it is probable, also, that when the cell has become ripe, and taken to itself and reconstructed all the material that it can, the office of the nucleus, which is to prevent annihilation of the cell during its activity, either perishes, or divides by the process of endogenous cell formation, and forms other cells, according to one of the observed phenomena of cell increase. The three methods by which secreting cells contribute to the discharge of the secreted fluid—bursting of the cell, exudation through the cell wall, and exfoliation of the cell in continuity—in a great measure depend upon the nucleus, the office of which is probably to maintain the cell as a secreting body and provide for the regeneration of cell forms.

The first step in the process of multiplication of glandular epithelium, that is, the initial step in secretion, is taken by the nucleus. This becomes constricted, and, dividing, induces a projection to form, into which the new nucleus passes, this projection becomes separated, when it forms an independent cell with secreting powers. Or this multiplication by segmentation, may, as in the mammary gland, be replaced by an endogenous cell formation, in which daughter cells are developed in the parent cell, and there remain until the destruction of the parent cell, when they pass out as independent bodies.

The conditions that determine the period at which a nucleus thus divides for the purpose of cell multiplication are not determined, but it has been suggested by Recklinghausen, that the migrating cells found between epithelial cells are conjugating organisms, and through their ability to fertilize epithelial cells induce in them functional activity; but considering the proportion between the number of

migrating cells and the number of fertilized cells, it seems probable that division of the cells is not brought about in this way. The secreting cells act by virtue of their inherent power to secrete ; placed in a position to secrete, they fulfill their office.

The basement membrane of glands, if not in all cases a continuation of the thin film of tissue that lies between the epithelium and corium, resembles that structure. It is a very thin, non-vascular tissue, composed of connective tissue cells, and forms the outer boundary of all the convolutions of glands. Its use in the construction of glands is probably : *first*, to limit the secreting organ ; *second*, to furnish a firm basis for the support of the glandular epithelium; *third*, to interpose a membrane, or filter, between the secreting cells and the bloodvessels.

With the basement membrane is sometimes mingled a few muscular fibers ; this is especially true in the ducts of the larger glands, and it is the contraction of these fibers that aids the secretion of the gland to flow against the force of gravity. Not only is a very large quantity of blood sent to each gland, but the arrangement of bloodvessels is such as to expose the blood to the influence of the secreting cells upon the largest possible surface, and also to cause the blood to pass slowly under the action of the cells. Hence it is found, that the arteries ramify to the utmost degree of minuteness, and that in no instance do they open upon the secreting surface, but without exception terminate in the returning veins. There are therefore between the gland cells, and the blood corpuscles, two membranes, that which forms the blood channels, and that which bounds the gland, through these, secretions must take place. The manner in which this is accomplished, has not been satisfactorily demonstrated. In certain numbers, the blood corpuscles may wander through the walls of the blood vessels, and also through the membrana propria, because this membrane has been demonstrated to consist of a network of cells that intercommunicate by processes, and not a continuous membrane, but the contact of blood corpuscles and gland cells, induced by this arrangement is not suffi-

ciently extensive to supply secreting cells with pabulum for their development and growth. It is probable that both direct contact and endosmose are concerned in secretion, the latter process referring to the more fluid elements of the blood.

The quantity of blood supplied to a gland is in proportion to its activity not its size. This is noticeable in the mammary gland during lactation, at which time the blood sent to the organ, is greatly in excess of the supply at any other period.

Compared with other organs, the veins of glands, are smaller than the arteries. This circumstance may receive an explanation in the physiology of secretion, for do not glands extract from the blood materials which if conveyed to other parts would pass into the circulation? this suggests a possible ratio between the secreted substance and the volume of blood that is returned from a gland, in a state of activity.

The lymphatics of glands are numerous, they ramify on the basement membrane, and pass out from the gland, with the blood vessels. They are lacunar in origin, arising in the irregular spaces that lie between, and surround the blood vessels, secreting tubes, and basement membrane. The cavities thus formed, are lined with flattened cells, similar to those found in other lymphatic vessels, and from these sacs, tubes lead through which the lymph is carried to the common lymphatic duct. There is no reason to believe that a natural communication ever exists between a lymphatic tissue and the gland cavity, those experiments that result from injecting fluids from a gland into its lymphatics, probably in all cases demonstrate, a pathological condition. But while this is true it is not denied that the walls of lymphatics are pervious to lymph corpuscles. Lymph is formed very much as glandular secretions take place, only in a reverse order, and it is not improbable, that cells do pass through the vessels ; but the passage may be regarded as due to the vital activity of the cell, which by elongating, insinuates itself between fibrils that close, after it has passed.

The nerves of glands are mainly derived from the system of the great sympathetic. Their fibrils surround and accompany the arteries into the interior of the gland, until they become so minute as to elude observation. From their distribution, it seems probable that their chief office is to regulate the supply of blood to the gland, and that they have little more to do with the activity, of gland cells, than indirectly to furnish them with their pabulum, but the investigations of Pflüger show that at least in the salivary glands, the basement membrane is perforated by the nerves without their medullary sheath, and that between the branches then formed, there is a connection established with the bioplasm of the cell, or its nucleus. It has also been claimed that in the testicles, the nerves penetrate the basement membrane, and terminate within the gland cavity, in "shining granular protoplasmic masses." How far this arrangement may determine the character of the secretion, or exactly the influence which the close proximity of nerves may have upon cell genesis, is not known, experiments have so far only established, that emotions may increase or stop the secretion, and that the former effect may be produced by strangulation of the nerve branches that supply the gland. It is probable, however, that those nerves that enter the gland cavity furnish the secreting cell with a necessary vital activity, for it is not enough that a cell should be furnished with pabulum, it must possess the power to appropriate that food to itself; and while it may be said, that because the gland cell is composed of living matter it is capable of functional activity without the influence of nerve cells, it is probable, considering the communicating function of nerves, that they convey a non-inherent activity from a central nervous organ, to the gland cells.

The parenchyma of glands, is composed for the most part of connection tissues. It fills up all the minute fissures and angles between the tubes and lobules, and gives a uniform shape to the gland. The cellular tissue also protects the blood vessels, lymphatics and nerves, that enter and pass from the gland, this use is noticeable in the glands situated

upon the external parts of the body, of the mammary and salivary glands, both of which are surrounded by a quantity of cellular tissue; in glands not exposed to injury, this arrangement is less marked.

PART II.

THE MAMMARY GLAND.

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The presence in certain vertebrates, of a gland opening externally, the secretion of which nourishes the young of the species, is characteristic of mammals. The name, from mamma—a teat, is not descriptive of the entire class, for in Monotremes the terminal ducts of the mammary glands do not project beyond the integument, but open directly upon the skin without prolongation into a teat or nipple. When however, this arrangement, by which suckling is facilitated, is absent, there is interposed between the gland and the integument a strong muscle, the panniculus carnosus, the fibers of which are directed longitudinally. leaving elliptical spaces for the passage of the lacteal ducts. This compressor of the mammary gland, the ileo-marsupialis of Cuvier, is the homo-type of the cremaster in the male, and Mr. Owen believes, that "the chief function of the ossification of the internal pillar of the abdominal ring, (marsupial bone), is to add the power of the pulley to the compressor of the mammary gland, and effect the requisite change in the course of the contractile fibers."

The mammary outlet differs in the two representatives of Monotremes. In the female Ornithorhynchus,—the mammary glands are not present in the males—the lacteal ducts open upon the surface of the skin without the slightest elevation, and the areola, at which point the secretion is discharged, can only be distinguished from the surrounding skin, after the hair has been removed, by the size of the orifices of the lacteal ducts. The absence of nipples, and of a vascular structure necessary for erection, would prevent the young from suckling, were it not for the strong compressor muscle, and a peculiar modification of the mouth of the Ornithorhynchus.

This is broad, and corresponds in size and shape to the mammary areola. The tongue is large and the jaws soft, and when applied to the duct surface, permits a degree of suction sufficient to overcome the difficulties of obtaining nourishment which would otherwise attend such a formation.

In the Echidna hystrix, the lacteal ducts also open without prolongation, but at the base of a tegumentary pouch. During the early period of extra uterine life, the long slender head of the young Echidna is thrust into this fossa, and its wide transverse mouth held in contact with the lacteal orifices by means of the fore claws which also enter the pouch. The Echidna pouch seems to be a rudimental marsupial pouch, but differs from the latter, not only in size, but in the period of its development. This is observed to take place after impregnation. In the young female Echidna, the mammary ducts open without any elevation or depression of the integument, as in the Ornithorhynchus.

The development of the mammary glands has been referred to two widely different processes. Balfour believes that they arise in the same manner as the other glands of the skin, as solid ingrowths of the epiblast, from which it follows that their ducts are the remains of a direct communication with the epidermis, and that their homologue is found in other cutaneous glands. Dr. Creighton following out the conclusions of Langer, and the early suggestions of Goodsir, from observation made upon young kittens and guinea-pigs, is led to adopt the opinion that the mammary glands are developed as independent bodies from embryonal connective tissue cells, and hence are developed from the mesoblastic germinal layer; that the ducts first appear as narrow tracts of embryonic cells, having no communication with the integument, and that the homologue of the mammary gland exists in the fat bodies found in many embryo mammals. The former, and more generally accepted opinion, being in accordance with the known course pursued in the development of other glands that open upon the integument, rests more upon analogous testimony, than upon special observation. The latter opinion, though rest-

ing upon careful observation, is founded upon insufficient data, and in its deductions is too speculative to be accepted as the conclusive explanation of the phenomena attendant upon mammary development; a review, however, of the facts upon which it is based, furnishes evidence that supports at least one aspect of the hypothesis.

There is a striking resemblance between the development, anatomical arrangement, and periodicity of functional activity, of the fat bodies and the mammary glands; there is also a marked similarity between the fat cell, and the functionally active gland cell; and when it is considered that these fat bodies precede in development and situation, in some vertebrates, the mammary glands, the likeness is still more striking. But we must not be misled by the novelty of Mr. Creighton's theory, to allow skillfully arranged facts to replace the weight of opinion and general laws of embryology, by what at present is little more than a brilliant hypothesis. The deductions that Mr. Creighton has drawn from his own most painstaking investigation have caused him to adopt a position that is not yet capable of proof, for it will be seen that an acceptance of his theory of the origin of the mammary gland, causes us to abandon the generally conceded belief that glands are developed from without inwards, but what is of almost greater importance, involves an exception to the law of development, that the dividing line between tissues, beginning in the blastoderm, is always maintained. For if the mammary gland is developed from the mesoblast, it is of connective tissue origin, whence then come the epithelial cells of secretion, if not from a transformation of connective tissue cells? So far, all evidence favors the position, that connective tissue does not give rise to epithelial cells, that wherever epithelial cells are found, they are the descendants of other epithelial cells.

In some embryo mammals, in insects and batrachians, there are found collections of adipose tissue, circumscribed, with definite boundaries that much resemble in form and structure, glandular bodies. There is, however, the marked difference, that these fat bodies are not possessed of any

means for discharging the contents of the fat cells. The fat bodies are divided into lobes and acini, and the fat cells secrete, or appropriate to themselves, a material that forms no essential part of their original construction. These fat bodies frequently occupy situations that in mammals are occupied by the mammary glands, and they are subject to a periodicity of activity that places them among the secondary or accessory sexual organs. In the embryo of kittens and guinea-pigs, upon which the observations of these bodies have chiefly been made, the fat bodies are found in the position of the future mammary gland, and when the gland begins to develop, it is among the fat cells that the first differentiated gland cell is observed. We find, however, upon examination, that this apparent derivation of the gland cells—epithelial cells—from fat cells—connective tissue—does not necessarily follow from the observations made, for there is, *first*, to be remarked, that all glands have more or less extra glandular fat, and, *second*, that this adipose tissue belongs to the structure into which the epithelial nodule is projected. This is especially true of the mammary gland, which is provided with a large quantity of protective fat.

From the facts obtained. we can not show that a more intimate relation exists between the fat bodies and the lacteal organs, than that the former sometimes precede the development of the latter, and that the mammary glands are developed in, but not from, the collection of adipose tissue.

Proceeding backwards, it is not clear how strong a relation can be traced between the fat bodies and scent glands of some animals. The latter frequently exude near the genital organs, and enlarge at the rutting season very much as do the fat bodies. And it is found that in male Monotremes, the mammary glands are actually replaced by an organ almost identical with a fat body, but which discharges a fluid calculated either to attract or excite, the female.

The first appearance of an organ that can be distinguished as a mammary gland, is found in the Monotremata, but so slight is the resemblance it bears to a well developed lacteal

organ, that it has been denied such an office. The observations however of Mr. Bennett, afford undoubted evidence that the female Ornithorhynchus, and Echidna, do possess glands that at certain times secrete and discharge a milky fluid that is drank by their young. The mammary glands of Monotremes are of the simplest construction, and may with almost equal justice be regarded as fat bodies or secreting organs. They are composed of one hundred or more tubes, slightly lobulated towards their free end, that converge towards the integument, at their fixed extremity. And they apparently do not open by regular orifices, but each part of the gland approaching the surface separately, probably discharges its contents by exudation, and that only under the excitement induced by the application of the mouth of the young mammal. As already said, the male Monotremata possess in the place of a mammary gland, a body that also partakes of the glandular functions—though closely allied to a fat-body—the *glandula femoralis*. In some respects this *glandula femoralis* is anatomically a higher formation than the mammary glands of the female Monotreme; its parenchyma is more complex, and it discharges through a duct, which alone marks a more advanced stage of gland evolution.

Next higher in the scale of mammals, having reference to the development of the mammary gland only, are placed the Cetacea, and advancing still another step, Marsupials. In the males of the former, there is yet found no mammary gland, but in its place, a large gland, which in the Porpoise discharges through a single duct, that opens farther back than in the female. The mammary gland itself, in Cetacea, is developed more towards the highest type, that found in man; for in it the lacteal fluid is collected into a principal duct, which terminates in a nipple, concealed in a cleft on the side of the vulva. In Marsupials is observed the first well marked development of a conglobat mammary gland, and in these mammals the nipples are very long, but this modification indicates an individual, more than a class development, and is sug-

gestive of use, rather than of an evolutionary feature. In proportion as the mammary gland partakes more of the true glandular structure and function, it loses the conformation of fat-bodies. Now in fœtal kittens, and guinea-pigs, in which the evolution of the mammary gland has been more successfully studied, it is found that a fat-body precedes in time and location the lacteal organ; that especially in the guinea-pig, the glandular and the fat-body are so intimately associated that they cannot be separated. This does not point to an identity of the two organs, for the fat-bodies of both the kitten and the guinea-pig are permanent bodies, nor can it be made to favor the development of the gland-cell from the fat-cell, no such metamorphosis has been observed, but it does indicate that the fat-body cells, and the cells that make the frame-work of the highly evolved mammary gland, have a common matrix, the connective tissue, for I look upon the permanent fat-bodies into which a lacteal gland grows, as contributing to the anatomy of the organ, exclusive of its secreting apparatus. These collections of adipose tissue contain connective tissue, the cells of which have not become infiltrated with oil. These enter into the construction of the acini of the gland, emphasizing the limiting membrane of the lacteal ducts, which pass through the adipose tissue, as lines of embryonal cells, looking to that more highly evolved form of a lacteal organ, in which connective tissue and epithelial cells shall exist as stroma, and secreting bodies, and the fat cells, which have no constructive power, shall be reduced to a minimum.

May we not, therefore, believe that the mammary glands in each species of mammal are preceded by a fat-body; that the secreting tubes are first developed in these collections of fat, that the most simple mammary glands contain a large proportion of fat; and that, when in later life, or in a higher form of mammal, the fat-body disappears in favor of the true gland, there is an example of organic substitution, not evolution, an instance of an organ low in function giving place to one higher in development.

Both fat-bodies and mammary glands are subject to

periods of functional activity. The former, as well as the simpler forms of lacteal organ, are seasonal in their excitement, while the latter in the higher mammals respond to the emotions, and are volitional in their functional activity. Thus when the organism comes under the dominion of reason, and is controlled by the higher intellect, those parts and organs that served a similar office on a lower plan, become rudimental, and finally disappear, the higher organism having no further use for them.

The mammary gland is of no definite construction, but varies from the simple follicle to a compound racemous structure; their only distinctive feature resides in the gland cell, and consequently in the function performed, that of lactation. They are accessory parts to the reproductive system, and as such their development is connected with the development of the reproductive organs. Thus in Monotremes and Marsupials, which are believed not to be provided with a placenta, the mammary glands are of primitive construction, and in Marsupials, the pouch, from which they derive their name, seems to be almost supplemental to the small uterus and short vagina, for it is "rudimental in the Dorsigerous opossum, which has the longest uteri and the simplest vaginæ; and we may conclude therefore that the young undergo a greater amount of development in the womb in this and allied species; * * * * In the Kangaroos and Potoroos, which have the shortest uteri and longest vaginal tubes and cul-de-sac, the marsupial pouch is broad and deep." This marsupial pouch is a duplication of the integument, at the posterior aspect of the abdomen, and extends over the mammary glands which are situated in that region of the body. The external fold is strengthened by longitudinal fibers of the panniculus carnosus muscle and the mouth of the sac, which is usually directed forwards, though in Perameles and Chaeropus, it opens towards the vulva, is closed by a strong sphincter muscle. Into this pouch the young marsupial is conveyed; in the case of the Kangaroo, after a gestation of thirty-eight days, in that of the Virginian Opossum, of twenty-two to twenty-six days.

At this time, the fœtus is helpless, and exactly the manner in which the young marsupial is conveyed from the uterus, whence it is expelled prematurely into the pouch where it lives until sufficiently developed to take on an independent existence, has until within a comparatively recent period, been a matter for speculation. It was thought by early naturalists, that the young marsupials were developed from the parents' nipples, for those investigators could conceive of no method by which the seemingly inanimate object found within the pouch, and adhering firmly to the nipple, could have been conveyed there. But in 1833, Mr. Owen, from observing a female Kangaroo, concluded that "the fore paws were not used for the transmission of the fœtus, but to keep open the pouch, ready for its reception, the new-born animal being deposited therein by the mouth, and held over a nipple until the mother had felt it grasp the sensitive extremity of the nipple." Mr. J. G. Shults' observations have led him to believe that at least in some Opossums, the transmission of the fœtus from the vagina to the pouch is effected by the mother bending her body, so as to bring the sexual opposite to the marsupial orifice; and that the latter opens by muscular action, to receive the young without assistance from either the paws or lips of the mother. When the marsupial pouch opens backwards the mouth is so close to the vulva, that an expulsive action of the vagina would transfer the fœtal mammal into its external uterus. After entering the pouch, the adaptation of the peculiar mammary construction to the requirements of the partly formed offspring is observed. The muscular fibers of the pouch, and its sphincter, hold the young creature firmly; the nipples are long and slender, with a slight enlargement of the free end, and are received into the fœtal mouth, where it is probable they remain until the marsupial is able to leave the pouch, and the milk, at least at first, when the young are too feeble to make much suction, is forced through the nipple by the ileo-marsupial muscle.

The marsupial pouch is not alone found in mammals, but reaches a considerable development in some fishes, but in these it appears only in the male (Syngnathus, ocus)

and is occupied by the ova, which are impregnated on their passage from the female. In this pouch the offspring remains until sufficiently developed to obtain food for itself, and to it returns when danger threatens. In some polyps also, (Hydræ Tubæ) creatures that propagate by "Parthenogenesis," "the ova are impregnated, and sheltered for a time in special marsupial pouches, the parent also performing the part of a nurse, and thence the young brood issues forth under its ciliated or infusorial form."

The extent to which brain conformation influences the development of the mammary glands, cannot be determined. Being parts of the reproductive system, which in evolution is closely related to the character of the brain mass, it is probable that the type of glandular structure represented by the lacteal organs in a species, corresponds to the stage of development of the brain formation of that species. Following the classification of mammals according to the cerebral system adopted by Mr. Owen; there is placed at the bottom of the scale, the Lyencephala. This order is represented by Monotremes and Marsupials. Their cerebral hemispheres are connected by the round and hippocampal commissures only, and their optic lobes are simply divided. This condition is associated with the primitive glandular development found in Ornithorhynchus, Echidna and Kangaroos, all of which are without true placentas and bring forth their young prematurely. Their testicles pass into the abdomen, protruding at the rutting season. The testicles of Marsupials are always contained in a pendulous bag, formed by the male marsupial pouch. In Lissencephala, represented by rodents, insectivora, cheiroptera, and bruta, which include such well known animals as the rat, hedgehog, bat, sloth, etc.; their brains are smooth, there is present the corpus callosum, and their cerebral hemispheres have the cerebellum and part of the olfactory lobes exposed. These mammals are true placentals, their young are born well developed, their mammary glands resemble less the follicular type, and are provided with teats; their testicles remain in the abdomen, and are protruded at the breeding season.

Most Gyrencephala, represented among many other orders by cetacea, carnivora, and quadrumana, are characterized by the relative size of the cerebrum, which extends over more than half of the cerebellum. The hemispheres are usually convoluted, more remarkably so in the larger species. Their placental development marks a still higher type, their mammary glands approach yet nearer to the structure found in man, and are always provided with teats. The testicles in cetacea, conformable to their aquatic life, are concealed, they are also abdominal in elephants, but in other orders the glands are possessed of a scrotum.

Mr. Owen says: "The mammalian modification of the vertebral type attains its highest physical perfections in the Gyrencephala, as manifested by the bulk of some, by the destructive mastery of others, by the address and agility of a third order. And through the superior psychological faculties—and adaptive intelligence predominating over blind instinct—which are associated with the higher development of the brain, the Gyrencephala supply those species which have ever formed the most cherished companions and servitors, and the most valuable sources of wealth and power to mankind."

At the top of the scale Archencephala, represented by one order Bimana, one example, man. The distinguishing characteristic of the human brain is found in the excessive development of the cerebrum over the cerebellum, the latter being reduced to but a very small proportion of the entire brain mass. In this class of mammals there is found the most perfect type of reproductive organs, and the most complicated glandular structures. In respect of development, the mammary glands follow the laws of evolution of all other species and organs.

The number, situation and external conformation of the mammary glands, is dependent in the fully developed species upon habitat, and the most perfect adaptation of means to perform certain ends, but while in a sense each ultimate part or organ may be contemplated as a unit, it is also true that the presence of that organ depends upon the functional activity of all the parts and organs, each one in

its sphere, which have preceded it in time of development. Hence the three descriptions of the mammary glands, number, situation and external conformation, cannot be regarded as alone determined by the conditions of life, but as forming a part of a phase of evolution.

In the normal condition, there are never less than two glands, and rarely more than thirteen, but it is questionable whether the latter number is found in any mammal. It may be said that each part of the gland that opens upon the integument separately, is an independent lacteal organ, in this way the number of glands is capable of almost indefinite multiplication. In aquatic mammals the glands are spread over a large space, one on each side of the body, in adaptation to their life. Thus in Cetacea, the lacteal glands are oblong, narrow, flat bodies, well protected by fat externally, each gland opening by a principal duct, which terminates in a nipple concealed in a cleft situated near the vulva. Between the periods of nursing the cleft remains closed. The female Coypii, who usually carries her young on her back when she goes in the water, has teats which project from the flanks nearer the back than the belly. These are seized and held by the young mammal during its transportation.

In mammals who bring forth many young at one time, there is usually a corresponding number of nipples. There are, however, exceptions to this rule. Prof. Wilder found an opossum with sixteen young, but only thirteen nipples, and Mr. Owen cites the domestic breed of the South American cavy, or guinea-pig, as a marked variation of this law. This rodent never has more than ten nipples, but has been known to give birth to twelve young. Does not this discrepancy in numbers mark a period of development, in which the young are less dependent upon the maternal care? As we have seen, the young of the lowest order of mammals probably remain in contact with the source of nourishment until a period which possibly corresponds to that at which higher creatures become extra-uterine.

The largest number of nipples is found in the tropical hedge-hog. The mammary glands extend from the pectoral

to the inguinal region, and are provided with twenty-two teats: in some shrews, the most posterior pair of teats project from under the base of the tail. In the elephant and dugong the lacteal glands and their teats are situated between the fore legs. In the man and ass the mammæ are situated a few inches in front of the vulva. There are two nipples, one on each side of the median line. The ducts, before they pass into the nipple, open into a reservoir, formed at their base, from which a pair of ducts are continued to the apex of the nipple. It is interesting to observe that not infrequently the domestication of mammals increases their prolific powers, both in regard to frequency of impregnation and the number of young, and also the number of nipples. Thus, referring to the wild guinea-pig which breeds but once a year, and then only one or two young; under domestication they begin to breed at two months of age, and gestation may be repeated at intervals of two or three months; also, the wild sow has eight nipples, but the domestic breed seldom less than ten. And in the wild cat, generally six nipples, increased to ten in the domestic animal. The nipple attains the greatest length in some of the inferior races of man, where it is capable of being thrown over the shoulder of the mother to the child carried on her back, the breasts also, in Hottentot women, grow to an enormous size, in some cases being pendulous almost to the knees, without appearing to be diseased.

The mammary glands are always provided with lacteal vessels, arteries and veins, and nerves. In bimana, the blood is derived through the subclavian and axillary arteries mainly, but in other mammals, where the gland is pubic or inguinal, the arteries arise from the epigastric; when ventral or pectoral, from the axillary, intercostal, internal mammary, lumbar, and epigastric. Sir A. Cooper remarks: "That the nerves differ in their distribution, but as to source, they obey one law, viz.: that they are composed of the two spinal roots of the grand sympathetic nerves; and hence the ready sympathy which exists between the ovaries, uterus and mammary glands."

The fully developed and functionally active mammary

gland, is found only in female mammals, but in the majority of male mammals,* there exists an organ of no definite use, that corresponds in situation to the female breast. It is a rudimentary mammary gland, composed for the most part of fat tissue formed into lobes, having very little that could be called truly lacteal or even glandular. The presence of this body in males is a subject for speculation, the fact of its close resemblance to the undeveloped breast of females, and the condition of the latter found after involution of the gland, in connection with the possibility of functional activity that the male organ possesses as shown by the ability to provide sufficient nourishment for the young when circumstances have required this from the father, the organ passing through all the changes that attend normal lactation, may possibly point to a prehistoric time when vertebrates first suckled their young, and both parents shared the responsibility of providing support for their offspring.

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* An exception has already been made in the case of monotremes.

THE HUMAN MAMMARY GLAND.

PART III.

CHAPTER I.

THE ANATOMY OF THE BREAST.

A consideration at this time of the anatomy of the breast is necessarily a reproduction of former demonstrations; it has, however, been thought advisable to review it briefly, for the purpose of affording greater convenience in the study of the physiology of lactation.

The human mammary gland is a compound racemose gland, which presents "*club-shaped gland vesicles*, situated at the extremity of a ramified system of ducts." The gland lies between two layers of fascia, the deep layer of which separates it from the pectoralis major muscle, and the superficial layer from the skin. The secreting apparatus is surrounded by a firm mass of connective tissue, the stroma of the gland; in this, but more especially near the surface, are considerable quantities of fat, in the form of lobules. Between the secreting cells and the stroma there is constantly interposed the basement membrane, an extra vascular structure not devoid of cellular elements.

The only connection between the mammary gland and the skin is made through the lacteal ducts, some fifteen or twenty in number, which open at the apex of the nipple. These excretory ducts are built up of fibrous connective tissue, the external fibers being circular and mingled with elastic fibers. This is not a true muscular development, the elasticity permits distension of the tube, but does not cause contraction; thus the flow of milk is in no degree aided by this arrangement. The ducts are lined with columnar epithelium, and the larger ones collapse when they are empty. As they converge toward the nipple, in the region of the areola, the ducts form dilatations, well marked during lactation, when they serve as temporary reservoirs for the milk. From these reservoirs are given off exceedingly small ducts, some of which pass to the gland lobules situated beneath the areola. The gland is composed of an immense number of lobes, which are divided into lobules and vesicles, each one of which is provided with a separate excretory duct, that opens into a larger duct, and this finally into one of the common excretory ducts.

The smaller ducts mentioned are formed of a layer of hyaline tissue, separated from the stroma of the gland by attenuated fusiform corpuscles; they are also lined with columnar epithelium. The gland vesicles, at their fundus, are lined with polyhedric epithelial cells, which pass into the variety found on the inner surface of the ducts.

The lobules are widely separated from each other at their free end, the inter-lobular spaces being wholly occupied by the stroma of the gland. They form solid bodies, being entirely packed with cells; some of the smaller ducts are also very densely packed with epithelial cells.

The nipple is composed of the terminal lacteal tubes, bound together with areolar tissue and plain muscular tissue. It is covered with cutis, prolonged from the common integument of the thorax, which dips down into the

lacteal ducts. The structure of the areola is very similar to that of the nipple. Situated at the base of the latter, it seems to be a flattening out of the more prominent part. On the surface of the areola are developed small glands and elevations, which serve for points at which lacteal granules, situated on the surface of the gland near the nipple, may discharge. It is probable that these papillæ, as well as the granules, secrete a substance which by lubricating the parts, prevents excoriation and injury from the mouth of the child, when nursing. The mammary glands are supplied very liberally with blood. This is mainly derived from the internal mammary, the long thoracic, some other branches of the axillary, and the subjacent intercostal arteries. All the large vessels supplying the gland run in the connective tissue, or gland stroma; from these the vessels divide, and as arterioles, generally accompany the ducts, and as capillaries form a fine net-work that envelopes the lobules and vesicles. This net-work rests upon the stroma aspect of the membrana propria, and possibly sends branches into that fibrous structure. The plexus of each lobule is quite distinct, and communicates with other plexuses only by means of small arteries and veins. The capillary vessels that supply the ducts also form a fine plexus that surrounds the tubes, and is continued as elongated vascular meshes upon the nipple. This is not a true erectile structure, for the vessels do not present any marked increase in caliber, the erection of the nipple, which takes place at the time of nursing and from sexual excitement, is occasioned by muscular contraction which probably prevents the return of blood through the venous system. The veins of the breast are somewhat larger than the corresponding arteries. They have a capillary origin in the plexuses which envelop the minute glandular divisions, and terminate in the axillary, internal mammary, cephalic, external jugular and subclavian veins. Both arteries and veins are arborescent in their arrangement, resembling in this respect the vessels of the uterus, and any organ subject to periodic enlargement.

The breast is supplied with nerves from the anterior por-

tion of the spinal cord ; the posterior portion of the spinal cord, and the great sympathetic nerve which unites with the dorsal nerves at the ganglion formed by the junction of the first two mentioned branches. The direct spinal branches furnish motion and sensation ; the sympathetic probably effects secretion, and binds together in functional activity the reproductive organs and the mammary glands. All the dorsal nerves, as they reach the sides of the chest, divide into two branches, a direct or posterior, and a reflected or anterior branch. Of the former, only branches of the fourth and fifth pairs are distributed to the breast ; they form a plexus around the nipple and areola. Of the latter, branches of the second, third, fourth, fifth and sixth nerves are distributed in the following manner : The second above the breast, anastomoses with the second posterior branch ; the third divides into two branches, one passes above the breast, the other accompanies the anterior branch of the internal mammary artery ; the fourth also has two divisions, one supplies the base of the nipple, the other, the upper and inner part of the gland ; the fifth branch passes to the integuments at the lower part of the breast ; the sixth is distributed below the gland. Prof. Muller could find no filaments from the sympathetic system in the mammæ, but Sir A. Cooper and Mr. Birkett assert that a connection between that system and the lactiferous organs is established through the dorsal nerves. In some of the lower animals, for example the ass, the third lumbar ganglion of the sympathetic sends a large branch to join the external spermatic nerve, a great part of which is distributed on the mammæ ; in animals in which these glands are situated upon the thorax, no such direct communication with the sympathetic nerves has been traced. Although it may be difficult to understand how such a communication is maintained through the dorsal nerves, it seems probable that the properties imparted to a ganglion may be transmitted by efferent nerves to a particular organ, and hence irritation in the reproductive organs may be conveyed through the splanchnic nerves or the lumbar ganglia of the sympathetic, and from thence to the thoracic

ganglia, which communicate with the dorsal nerves supplying the mammæ.

The lymphatics of the breast are intimately concerned with the physiology of lactation, and hence with the pathology of the mammary glands; they will therefore be dwelt upon somewhat in detail. The following description of the course of the lymphatics of the breast is taken largely from Sir Astley Cooper's Anatomy of the Breast.

The mammary lymphatics are numerous, and may be divided into superficial and deep. The superficial vessels arise from the nipple, and pass upon and under the superficial fascia towards the axillary side of the gland. They then lie upon the intercostal muscles, and passing through the fascia axillæ, enter the axilla where they join the first set of axillary glands. The vessels after descending, enter another set of glands, ascend to about one inch below the clavicle, where they form a considerable plexus upon the axillary vein. From this plexus a trunk is formed which on the right side terminates at the angle formed between the right jugular and right subclavian vein, and on the left side unites with the thoracic duct at the angle between the jugular and subclavian veins of that side. Besides these, there are 'other lymphatics which pass behind the axillary vein, artery or axillary plexus of nerves to form the absorbents of the arm.' The superficial absorbents of the sternal side of the mammæ penetrate the intercostal muscles, and enter the anterior mediastinum, where they are in relation with the internal mammary artery and vein, and pass into lymphatic glands. Some of the lymphatics from the right gland are traced to a union with like vessels from the convex surface of the liver.

The deep lymphatics, with lymphatic glands, are situated in the stroma of the gland. They form free communication with the superficial vessels, mainly upon the cutaneous surface of the breast, and finally pass into the axillary glands. The deep lymphatics of the breast probably arise in spaces in the connective tissue which forms the stroma of the gland, that is, they are *lacunar* in origin, their smallest branches are capillaries

and in close relation with the blood capillaries; their largest branches become the afferent vessels of the gland. Besides this tubular arrangement of lymphatics, they sometimes assume the character of fissures or lacunæ, and as such invest the arteries and veins as with a sheath.

There is no regularity in the distribution or course of lymphatic capillaries, and there seems reason to believe that this may change in the same gland, for having their origin in indefinite spaces in the connective tissue, which is sufficient explanation of their irregular course, these spaces are liable to change and increase, in certain directions, with the development of other cellular elements which spring from that tissue. It has not been demonstrated that the lymphatic vessels of the breast are possessed of a special wall or an endothelial lining, but since both these have been shown to constitute a part of the anatomy of other lymphatics, it is probable that those of the mammary gland form no exception to the general rule. The vessels, however, are pervious at all points, though these openings, *stomata*, never exceed the size of an endothelial cell, but they are sufficiently large to permit absorption of materials from the surrounding tissues. This tissue, the connective tissue, is traversed by numerous canals, which are directly continuous with the lymphatic vessels, and through these canals the waste products of lactation are conveyed into the lymphatic passages. It was formerly believed that an epithelial covering served as a protection, that, except in the case of glandular epithelium, it was impervious to cells, but this cannot now be maintained. It is probable that in all cases, including the bloodvessels, there may at times be a free interchange of histological elements between the edges of epithelial cells, which line or constitute the walls of a cavity, and that during lactation the waste or large pigment cells pass from the glandular acini into the connective tissue, in which they are found in large numbers, into the serous canals, and thence into the lymphatics.

The lymphatic glands of the breast are situated principally beneath and in the center of the mammary gland,

and so intimately are they associated with lactation, that they are not noticeable when the mammæ are inactive. In common with other lymphatic glands, they are composed of a cortical and medullary substance. The former constitutes in general the covering, and is composed of connective tissue, with a few muscular fiber cells; the latter, the interior of the gland. The entire gland substance is supported upon a trabecular framework, or stroma of His, which consists of connective tissue, with a slight intermingling of involuntary muscular fibers. This fibrillar tissue forms a close net of bands which are stretched across the different divisions of the gland, and in the meshes of which the gland cells rest. In the cortex of the gland are situated both round and pear-shaped follicles; this tissue is made up of a dense mass of small lymphoid cells, imbedded in the trabeculæ of the gland. Between the medullary substance and the follicular tissue are left continuous open spaces, the lymph-sinuses. These are not perfectly open and empty spaces, however, but are traversed in all directions by bands of trabecular tissue. Into the lymph-sinuses the afferent vessels empty, and hence any material conveyed to the gland is filtered through the fine network, before it passes out by the efferent vessels, situated opposite the afferent channels at the hilus. The connective tissue framework of the lymph-sinuses is occupied by lymph cells and the large pigment cells, and it is probable that in these passages the granular cells become nuclear by the changes they undergo as a necessary part of their slow circulation through the hilus of the gland.

The blood circulation of the gland begins with arterial trunks that enter at the hilus, in the stroma of which the branching takes place. The largest supply of arterial blood passes to the medullary substance, and from branches given off there, the follicles are furnished with blood. The capillary network, out of which the venous system arises, is spread out upon the medullary cylinders which are found between the inward projections of the cortical substance, and are surrounded by the lymph-sinuses. The follicles are supplied with blood by an extension of the arteries

which pass to the medullary cylinders, and a capillary network is formed, with venous origin like that of the cylinders. The venous trunks pass out at the hilus of the gland, by the side of the arterial trunk. The lymph-sinuses contain no bloodvessels.

CHAPTER II.

THE EVOLUTION OF THE BREAST.

The evolution of the breast relates to those changes that take place before and during puberty, and those associated with gestation, which includes the period of lactation; these will be considered separately.

The mammary gland is first observed about the third month of intra-uterine life, in the form of the principal ducts of the future organ. From the sixth to the seventh month the acini begin to form, around the deeper end of the duct, and in close connection with the connective tissue and fat lobules in which it lies. At the time of birth, the gland is highly vascular, and is divided into from twelve to fifteen lobules, the ducts of which are composed of connective tissue lined with small cylindrical epithelial cells. The gland is situated opposite the future nipple, and is about the size of a large pea. At this period there is no difference between the breast of the male and the female. When the gland begins to assume a distinct shape, about the seventh month of fœtal life, the nipple is observed as a depression, as if the ducts and lobules in their development had drawn it inward; later, the connective tissue covering of the gland elongates in the form of a cleft body, at the apex of which the lacteal ducts open. It is interesting to observe that the anomaly of a cleft or bifid nipple is the continuation of a normal intra-uterine period of development. From birth to the development of the reproductive organs, there is usually but little change in the mammæ. The individual parts grow, but Langer is probably right in believing, that before men-

struation is established, there are no true gland vesicles formed. When ovulation, which Mr. Lawson Tait believes begins at a very early period of extra-uterine life, proceeds in connection with the functional activity of the Fallopian tubes, which marks sexual maturity, the gland begins the development of the perfect secreting apparatus, which consists in enlargement and separation of the individual lobules and acini, and their more general conversion into hollow bodies, lined with epithelium. With these changes there is also an increased development of fat and connective tissue. The lymphatics undergo changes that prepare them to remove the waste elements from the lacteal organs, and to a certain extent this probably takes place at each menstrual period. Hence, before impregnation, the breasts are only semi-quiescent, only sufficiently developed and active to begin the process of evolution which consummates their usefulness and functional activity.

It is probable that the evolution of the mammæ, which results in the formation of milk, and which is instigated by the presence of a fœtus in the womb, begins with conception. The changes towards a more perfect development are very slight at first, but those steps of the process which have been under observation are known to be so gradual, and so accurately in accordance with the increase in size and development of the fœtus, that it is reasonable to assume that from the moment of the impregnation, while possibly the ovum is in the Fallopian tube, the breasts begin to evolve the structure that adapts them to perform lactation. This process is at first probably associated with an increased blood supply, in the same manner in which the uterus prepares to receive the ovum. With increased nourishment, the connective tissue and fat-cells multiply, and the breasts become larger and fuller. Before, however, there is much change in size observed, the glandular acini begin to develop, and it is probable that this part of the gland is the primary point of evolution, that in the acini the entire process originates. There is no reason to believe that either the lobules or acini become more numerous in the active state than they are when the organ is at rest,

their development relates to increased size, and takes place from the center of the gland. There may be at times the appearance of the division of one acini into two separate bodies, but this probably arises from the separation of two divisions that had become approximated in the resting state.

With the multiplication of the nucleated cells which occupy the terminal vesicles of the undeveloped gland, there are found, even at an early stage, large yellow granular cells. These pigment cells mark a stage in the development of secreting cells, and towards the close of pregnancy are mostly found in the ducts of the gland, being pushed forward by the true secreting cell. They resemble connective tissue cells, and are found in relation with spindle-shaped cells of granular substance, and indeed have been seen to assume the same shape as these in the interlobular and interacinous tissue. It therefore becomes a question whether these pigment cells are a true glandular product, or are connective tissue cells, but there is strong evidence of their glandular origin; that they, in common with many other cells found in the gland stroma, are of epithelial birth. These pigment cells probably gain access to the interacinous tissue by passing through the walls of the acini. At first this takes place because there is no communication between the acinous and the excretory duct; and later, because though more numerously formed in the early stages of evolution, and they continue to be thrown off, even during lactation, the distention of the glandular walls renders them more pervious to the passage of cells. As evolution advances, the acini acquire such a size as almost to crowd out the stroma of the gland, which finally appears as septa of connective tissue, dividing the glandular structure. This compression brings both the lymphatics and bloodvessels, which lie in the stroma, in close relation to the secreting apparatus, and so facilitates the functional adaptation that exists between the several parts of the mammary mass. As the process of evolution is brought to a close, the acini are observed to be lined with vacuolated epithelial cells, which seem to lie on one side of

the basement membrane, but before then ucleated epithelial cell passes from a hyaline to a granular state there are found the colostrum cells, "which are the last of the long series of imperfect secreting products that have been thrown off during the evolution process." These colostrum cells are rich in fatty constituents, and form a large proportion of the first milk discharged from the gland. Mucus is a constant product of vacuolation, and this is found to occupy the central spaces of the well developed acini.

The process of evolution proceeds through regular and well marked stages. The slowness of the development, compared with other glands, insures a most perfect arrangement of the organ for the coming lactation, and prepares the parts of the breast, not only to furnish nourishment, but to remove the waste tissues that follow and accompany lactation.

CHAPTER III.

INVOLUTION OF THE MAMMARY GLAND.

During the period of lactation, the mammary gland is maintained in a state of functional activity. Having by successive steps acquired the highest form of development, and with this, the full exercise of its powers, unfolding has reached its limit, and therefore gives place to the proliferation of the cell type thus evolved. But when the demand for lacteal fluid ceases, the gland begins a process of involution or up-folding, by which the secreting apparatus is reduced to a resting state, and by which it finally returns to the inactive condition that preceded evolution.

The stages of involution correspond, though in a reverse order, to the steps of evolution. With the latter, the large pigment cells appear early in the process, in the former, they are associated with the final phenomena; the unfolding begins with changes in the cellular elements of the acini which result in passing from a nuclear to a granular state; the up-folding begins with the granular, and passes

gradually to the nuclear cell formation. But it is to be noted that involution consumes a short time compared with evolution, the entire period required for the gland to subside into a state of rest, after the demand for milk has ceased, being but a few weeks, when, as it has been seen, evolution involves the entire period of gestation. With this difference between the two processes, there are associated important physiological phenomena, for while the synthetic is necessarily slower than the anyletic process, and the construction of tissues is more taxing upon the system, and hence must, if continued without detriment, and within the limits of health, be extended over more time ; it remains true that the subsidence of lactation is accomplished with remarkable rapidity, when it is considered how much actual tissue must be removed from the gland, and the changes which take place in the histological elements of secretion, for the resting cell is only acquired through many generations of the vacuolated granular epithelial cells. One reason that the involution process can proceed so rapidly, is found in the large development of the lymphatic glands and their ability to remove the waste elements as fast as they are conveyed from the gland to the lymphatic circulation. The lymphatics with their glands, therefore, perform a most important function in connection with involution, and are equally important ones in the ætiology of mammary pathology.

The initial point of the process of involution resides in the vacuolated epithelial cell. This form of cell life represents the maximum of lacteal activity, while the minimum is represented by the irregular nucleated bodies, devoid of a protoplasmic fringe, which form a mosaic upon the floor of the resting acini. As evolution involved the development from this naked nuclear body of a body almost devoid of cell contents, of a body the most prominent character of which is represented by a cavity filled with fluid, held within a wall, which is all that remains of the original cell substance, so involution, beginning with this vacuolated cell, involves the gradual loss of the vacuolar character, until the gland elements subside into

inactive nuclear bodies. The several stages by which the resting gland cell passes into full activity, and again into its former condition, represent the morphology of the lacteal epithelial cell. During this life cycle, there are many stages through which the cells pass, which do not continue as representative cell forms, but seem to serve no other purpose than as intermediate wombs, in the evolution of permanent forms. These are generally spoken of as the waste products of secretion, but while they may be removed as useless, so far as their future history is concerned, to the glandular function, it is not probable that they are wholly effete matter to the system at large. The most marked cellular products of the subsiding function of secretion, are the large number of minute lymph cells found in the acini, and in the interacinous tissue, that may probably be traced to the epithelial cells within the acinus, and also the large sized pigment cells that appear towards the close of involution. These pigment cells represent a feeble glandular power, and may be regarded as but slightly removed from the naked nuclear body, and it is possible that the latter is in many instances the nucleus of the pigment cell, after it has lost its vacuolated pigment character. The pigment cells are found in greatest number outside of the acini, they seldom exceed two or three within the gland. From the interacinous spaces they gain access to the lymphatic vessels in the manner already described.

With the reduction of the number and size of the cells within the acini, there is also a shrinking of the acinus walls, and hence the gland substance proper becomes smaller, but with this contraction of the gland there is an increase of the connective tissue stroma, and consequently interacinous tissue. The fat beneath the gland also increases, especially when the connective tissue does not develop sufficiently to occupy the space left by the contracting gland. The spaces in which the lymphatics run are thereby augmented to meet the requirements of the increased size of the vessels. With the up folding process of the mammary gland, there is a diminution of blood supply. Whether this precedes the cellular changes which begin in

the vacuolated cell, or is caused by those changes, is not determined; it is probable, however, in consideration of the increased supply of blood which accompanies any irritation, that the act of nursing is first felt upon the organism in a diminution of blood and, therefore, that this precedes cellular changes.

The great evolution and involution of the mammary gland are felt at the first preparation for functional activity, and the final upfolding of the lacteal function; but to a limited degree, causing spurious excitation, the same processes are gone through with at each menstruation, and it may be said that the gland after puberty has no rest, it is either unfolding or upfolding during the entire period of its usefulness.

CHAPTER IV.

THE SECRETION OF THE MAMMARY GLAND.

While *in utero*, the fœtus receives nourishment through fluids placed in contact with it, and through the placental circulation; but the condition of the offspring consequent upon parturition necessitates some food for its support, other than that upon which it hitherto subsisted. The food must be easily digested, and contain in a preëminent degree, all that will nourish the young organism. That healthy milk meets these requirements is confirmed by the fact that at no time of man's existence is growth so rapid and perfect, at no time is the formative power of so high an order, as when he depends wholly upon the breast for support. It has been thought therefore by Prout and others, that milk must be the standard of food, "that it is a kind of prototype of the nutritious elements in general," but such a deduction is not well grounded, for we may feed children on milk, and they thrive, but if adults are subjected to similar dietetic rules, beneficial results are not so likely to follow, and for the reason that with advancing

years there is an increased waste of tissue, hence the requirements for nutritive elements in different proportions from those that meet the demands of infant life.

It is not clear to what may be attributed the continuance of lactation, unless the function is placed within one of the universal laws of nature, that the supply shall equal the demand. All physiological processes originate in mutually dependent physiological laws, and while the evolution of the lacteal function receives an explanation in the ultimate demands of gestation, acting through the presence in the uterus of the product of conception, and involution is accounted for by the fulfillment of those demands, there seems to be no physiological condition that calls out the high degree of active force required to maintain the endogenous cell formation of lactation. There is nothing in the vacuolated milk cell that must be removed from the system ; there is no advantage gained by the parent organism in the secretion of milk, and hence, while we cannot doubt that lactation comes within physiological laws, and these laws so mutually dependent that the entire system renders the secretion of milk a physiological necessity, we can at present go no further than to attribute the continuance of lactation to the sympathy existing between the maternal organism and that of her offspring. A sympathy, the peculiar nature of which ceases when the offspring no longer requires food at the maternal breast. Upon biological grounds also, there seems to be no reason for regarding the relation between the mammary function and the reproductive organs as more than accidental, for in the first place, they are developed from the epiblast, while the genital organs have their origin in the mesoblast ; and in the second place, like other cutaneous glands, their function is a purely local one.

Milk does not attain its normal character before the third or fourth day after delivery. That which is secreted immediately before and after parturition is thin and contains but a small proportion of saccharine and oily material. The colostrum cells, which form a chief constituent of the first milk, are imperfectly vacuolated epithelial cells, con-

taining fat in considerable quantity, and before they are discharged with the milk give out fat globules.

The secreting action of the mammary gland is almost continuous after it has been once established, though there are periods at which the milk is produced in greater abundance than at others. At such times a sudden rush of blood to the breast takes place, and so greatly does this increase the activity of the gland, that the milk will sometimes spurt from the nipple.

That the "draught of the breast" is a nervous action, is shown by the known influence to produce it which mental phases possess. The sight of the child, especially when this occurs at a time of emotional excitement, will cause a rapid, but temporary, flow of milk. During the moments of nursing, the milk is either produced in greater quantities or having been formed, is stored up for use, for it flows from the gland more rapidly and more abundantly than at other times. It is probable that, to a certain extent, the dilatations of the lacteal ducts serve as reservoirs for the milk when the gland is not in use, but the size of the reservoirs is not sufficient to contain even a small portion of the milk taken by a child during a single nursing, and hence it would seem that the gland not only secretes between the acts of suckling, but that at such times the functional activity of the gland is stimulated, the source of this stimu lation is to be found in the application of the child's mouth to the nipple, and the pressure of its hands upon the breast.

During the whole period of lactation, which varies from eight to twenty months, but may be terminated at any time by disuse, a proportionally large quantity of blood is furnished to the mammary glands, but especially is this true of the period embraced by the four days that precede and follow parturition. Soon after the gravid uterus falls in the abdomen, the breasts become more congested, and more markedly active, this activity continuing until the true milk is established. As the congestion attendant upon milk-fever subsides, which congestion is probably correlative to the diminished uterine vascular supply consequent upon the removal of the organism nourished through its walls, the

continuous supply of blood to the mammæ, is provided for by the suspension of the menstrual flow during lactation. For while it is not very rare that a mother menstruates while she is pregnant, or while she nurses her young, it is not in accordance with the general law of reproduction that she should do either, and it may be doubted, whether in the one instance, the child is not born physically weaker, than if the blood that should have remained in the system had nourished the uterine life ; and in the other, if the secretion of the mammary gland is not in some manner poorer in quality, and less fitted to nourish the extra uterine being. Any physiological changes occurring during lactation, which draw upon the entire organism for support, produce a direct effect upon both the quantity and quality of the milk ; the lacteal secretion is also altered in some respects by fright, or excessive, even pleasurable, emotions. This is also true of the period of gestation, for while a demand for nourishment may be made upon the system during pregnancy, as a uterine fibroid, or an ovarian tumor, and pregnancy proceed, either the mother or the child must suffer from such a demand.

It is probable that as the child grows it requires food in somewhat differing proportions, and this while yet dependent upon the breast for support, but it is also probable that changes, agreeable to the requirements of the developing organism, take place in the lacteal fluid. The differences between the first milk, and that which is typical of the permanent secretion, can have no other relation to the offspring than that of its physiological needs. These are, while the child is gently nourished, it being essential that the change from intra to extra uterine life should not be too sudden, that it shall at the same time be assisted in getting rid of the accumulated waste of its intra-uterine existence. Colostrum meets both of these demands, and hence, aside from the position held by the colostrum cell in the morphology of the secreting cell, the peculiar constituents of the first milk conform to the first demands of extra uterine life.

The influence of the nurse's diet upon the secretion of

milk has been an important subject for investigation, but there has not been observed any direct relation between the quality of food and the quality of the milk, save that the former should be nutritious. No children are stronger or better nourished than the children born of Scotch and English peasants. The mothers of these humble people live on meal of various kinds, milk and broth ; they work hard, and rise from their lying-in bed two to three days after delivery. This question is of great importance, from its bearing upon the dietetic direction to be given to nursing women. From the fact that the phosphates of lime are essential constituents of the blood that accompanies the secretion of healthy milk, it is justly reasoned that any food containing these inorganic elements is preëminently suited to the requirements of the nursing woman. Hence the explanation of the well nourished children of the Scotch and English peasants. Nitrogenized food, also, is well adapted to sustain the lacteal function, though in general it may be said, that a diet that nourishes the mother will furnish the best milk, this will, within certain limits, be individual. It is probable that all articles of food that enter the blood during lactation, are conveyed directly to the mammary gland, and there subjected to the manufacturing process which results in epithelial vacuolation. If they are not suited to the composition of the lacteal fluid, they remain in the granular cell, because the duration of the milk cell life is not sufficient for the foreign element to pass out of the cell, indeed it is not certain that as long as the gland is functionally active, the contents of the milk cell ever pass out of the cell envelope, save by rupture of the latter. This is observed when certain medicines are administered to the nurse ; for example, preparations of iodine, which are easily detected in the milk. In this respect the human nurse seems to be more easily affected than other mammals, as shown in experiments made with the iodide of potassium upon asses. Dr. Rees, upon the authority of Chevallier, Henry, and Peligot, asserts that this drug cannot be detected in the milk of asses if administered in much less than drachm doses, while he has detected it in women

after giving forty-five grains in doses of five grains three times a day. The effect of alcohol upon the secretion of milk is probably entirely that of a stimulant, exciting the gland cells to increased action, and like other stimulants, is followed by a reaction, or diminished action, when its use is discontinued. The use of malt liquors to increase the flow of milk is too prevalent, and cannot be without influence upon the child, in the quality of milk, because being forced, this suffers. The action upon the nurse also is to be deprecated, as being that of a stimulant.

The general accumulation of fat in the places where adipose tissue is naturally formed, is commonly observed during lactation, but whether this has any other significance than showing that all the fatty elements of food do not pass exclusively into the milk has not been ascertained. Possibly it is stored, to be drawn upon during lactation, or in some manner to assist in maintaining health during mammary involution, for with the completion of the up-folding of the gland, the fat frequently disappears.

The quantity of milk secreted varies according to circumstances. Sir Astley Cooper found, after many experiments, that the morning was more profuse than the evening milk; he further stated that two fluid ounces can generally be drawn from the full breast. Lampérierre made sixty-seven experiments, from which he concluded that from fifty to sixty grammes of milk were secreted in ten hours, and Lehmann, basing his calculations upon the same data, estimates that in twenty-four hours the average quantity of milk discharged is about 44.5 fluid ounces.

Milk has an average specific gravity of 1032. When perfectly fresh, the fluid is decidedly alkaline, though it soon becomes slightly acid in reaction, the change taking place more rapidly in cows than in human milk. Milk does not evaporate by heat, but owing to the action of heat on caseine, a thin scum forms on the surface, after boiling. Though the lacteal fluid contains a small proportion of albumen, it does not seem to evaporate upon boiling, if this is done in an atmosphere of carbonic acid, or of hydrogen, or in a vacuum.

When milk evaporates spontaneously, or by something acting upon its caseine, it separates into a curd composed of caseine, a large proportion of fatty particles, and a yellowish-green serum,—whey. If milk is allowed to stand exposed to the air, a change takes place somewhat analogous to that which occurs in blood, it separates into two portions; most of the globules rise to the top, forming cream, which has a specific gravity of about 1024; the heavier portion is of a bluish tint, and contains a very small proportion of globules; its specific gravity is about 1034.

Cows' milk, which is generally used as a substitute for human milk, has a specific gravity of 1.0338, and contains more caseine and less sugar, and is not so rich in butter as human milk. Goats' milk, from its composition, might well be substituted for human milk, but for its very unpleasant odor, depending upon a peculiar acid that it contains—hicric acid.

The colostrum, which precedes the appearance of the true milk, is a purgative, removing the meconium, with which the bowels are loaded at birth. Colostrum contains more sugar and inorganic salts than milk, and the pure colostrum contains a large proportion of albumen, which gives place to caseine. The corpuscles have a diameter of from 1-2500 to nearly 1-500 of an inch, and have neither nucleus nor cell wall. Virchow holds that the only difference between the milk cell and the colostrum corpuscle arises from the rapidity with which the former is formed; and that the milk cells were formed by the coalescence of the granules of the colostrum corpuscles, but this cannot be maintained, since it has been shown that the colostrum corpuscle has a definite position in the morphology of glandular epithelium. Colostrum decomposes more rapidly than milk, and in the normal condition the colostrum corpuscles are not found in any quantity after the fifteenth day of lactation, but their appearance is almost constant when any abnormal condition disturbs the secretion of the milk. It is also noticed, that with the abnormal presence of colostrum corpuscles, there is also an increase of the pigment granules that belong to the evoluting and

involuting states of the gland. Does not this point toward a feeble rather than an excessive action of the gland, as the possible cause of at least some pathological conditions? A certain correspondence has been thought to exist between the quantity and quality of colostrum and the subsequent secretion of milk. Donné concludes, after many experiments, the best time for conducting which he considered to be about the eighth month of gestation, that when the colostrum corpuscle is small, very little milk will be secreted after delivery; it is usually more abundant in multiparæ than in primipara.

ANALYSIS OF COLOSTRUM. (Flint.)

Water,		945.24	to	851.97
Albumen,		29.81	"	80.73
Butter,		7.07	"	41.30
Sugar of milk,		17.27	"	43.69
Chloride of sodium,	0.51			
" " potassium,	1.25			
Phosphates and sulphates of potassa, of lime, and of magnesia,	2.96	4.41	"	5.44
Phosphates of iron,	0.01			

ANALYSIS OF HUMAN MILK. (Flint.)

Water,		902.717	to	863.149
Caseine (desiccated),		29.000	"	39.000
Sultr-proteine,		1.000	"	2.770
Albumen,		traces	"	0.880
Butter 25–38	Margarine,	17.000	"	25.840
	Oleine,	7.500	"	11.400
	Butyrine, caprine, caproine, capsaline,	0.500	"	0.760
Sugar of milk (lactine or lactose)		37.000	"	49.000
Lactate of soda (?),		0.420	"	0.450
Chloride of sodium,		0.240	"	0.340
Chloride of potassium,		1.440	"	1.830
Carbonate of soda,		0.053	"	0.056
Carbonate of lime,		0.069	"	0.070

Phosphate of lime of the bones,	2.310	"	3.440
Phosphate of magnesia,	0.420	"	0.640
Phosphate of soda,	0.225	"	0.230
Phosphate of iron (?),	0.032	"	0.070
Sulphate of soda,	0.074	"	0.075
Sulphate of potassa,	traces		
	1,000.000		1,000.000

OR, AN ANALYSIS OF FORTY-THREE SAMPLES OF WOMAN'S MILK, MADE BY PROF. ALBERT R. LEEDS.

	Average.	Minimum.	Maximum.
Specific gravity,	1.0317	1.030	1.0352
Water,	86.766	83.34	89.09
Total solids,	13.234	10.91	16.66
Total solids not fat,	9.221	6.57	10.09
Fat,	4.013	2.11	6.89
Milk-sugar,	6.997	5.40	7.92
Albuminoids,	2.058	0.85	4.86
Ash,	0.21	0.13	0.36

Milk contains the three classes of organic principles which form the chief food of animals: albumen, sugar and fat, and also a large proportion of the mineral constituents that enter into the formation of bone.

Milk corpuscles may be seen with a magnifying power of from three to six hundred diameters. They are highly refractive, and float, or are suspended, in a clear fluid, the contents of the ruptured epithelial cells. They have a diameter of from 1-25000th to 1-1250th of an inch, and are generally quite distinct from each other. At present, there seems to be very little doubt that the milk corpuscle, the vacuolated epithelial cell is a true anatomical element; that is, that the fatty and other materials of which it is made up are contained in a delicate membrane composed of caseine (albumen, Virchow), called by Anderson *haptogenic.* Henlé was convinced of the presence of such a membrane by experiments made on the milk globules with acetic acid. This membrane is, as has already been said, the remains of

the cell substance from which the milk cell is developed, and varies in thickness with the degree of vacuolation which the individual cell has attained, and consequently with the force of the lacteal process. In a high degree of lactation, probably an almost imperceptible envelope exists, but here the cells are formed rapidly and pass through the stages of evolution toward perfect milk in a short space of time. Were they destined to be more permanent bodies, they would perish in the slightly enveloped condition in which they are found in rapidly secreted milk: where the function is more slowly performed, the milk corpuscles must preserve their individuality, and hence the process of vacuolation is not complete.

PART IV.

THE ÆTIOLOGY OF THE MAMMARY GLAND.

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The prototype of disease is found in healthy development and growth ; the same laws govern both processes, viz., those which relate to methods of receiving and appropriating nutritive material ; and while in the one case this proceeds only so far as to conduce to the well being of the entire organism, and to such an extent as to render the particular part capable of the highest functional activity, and hence of filling its place in the ecomomy ; in the other case no regard is had for the general good of the organism, but the part so nourished is in a sense removed from the system, and its existence is maintained independently of the mutual relations observed in the harmony that is essential to health.

In general, a simple error of nutrition, when the system is otherwise healthy, produces no more than a temporary derangement of harmony, the diseased cells either recover their position, or are cast off, their place being supplied by new and healthy cells ; there is a desquamation of the unhealthy elements. But if these conditions are reversed, if the constitution is tainted by some inherited or acquired tendency, if the error in nutrition is of such a character as to require the co-operation of the entire organism for its restoration, and hence involves a length of time, the cellular elements concerned either retain a primitive type, or are hypernourished, which has to do with a nuclear or granular condition of the cell and the general methods of cell multiplication, and, at least in the individual thus affected, show no tendency to return to their normal condition as units in a healthy organism.

The circumstances that determine the permanence of

types thus acquired, and their power to so enter into the construction of the body as to be transmitted through the germinal elements, and thus appear in successive generations, are not known. It is probable that the laws of heredity in disease are not far removed from those of health, or from those which determine the inheritance of physical defects. The latter are truly diseased conditions, for they are neither in conformity with the general type, nor conducive to the greatest usefulness, and still, aside from the local formative deviation, there may be nothing that can properly be called disease. In this connection, it is submitted, that the ovum and the sperm cells contain the essence of the organisms from which they proceed, and in this sense are secretions of the entire system, not of the ovaries and testicles only, and that any condition, which has become so entirely a part of the life of the individual, as to receive a form agreeable to that condition, be this of one cell, or of an entire organ, or member, will be represented in the germinal elements of that individual, and unless counteracted, will be reproduced in the offspring of that individual.

Deviations from the typical form of the body are first molded in the germinal layers of the embryo, either as an excess, or deficiency of developmental cellular elements, for to these two forms may all deformities be referred ; but this subject will receive especial attention in a subsequent chapter of this Treatise.

Diseases of the mammary gland may probably, with few exceptions, be traced to the phases through which the gland passes, from rest to activity, and from activity again to rest. The period of lactation, while concerned in the ætiology of some diseases, has not so much to do with the pathological new formation developed in the breast as the processes of evolution and involution. The reason for this is not obscure. During both the unfolding and up-folding of the mammary gland, there is much cellular waste, cells that do not attain the type which fit them for the highest use in the economy, and hence have no physiological office to perform in relation to lactation. These cells, the granu-

lar cells of lactation, and there is reason to believe that the well developed and formed cells are not concerned with the origin of pathological new formations, only the waste cells, those destined to be cast off, enter into the origin of such growths. The cells pass through the acinous walls into the surrounding connective tissue, where failing to reach a lymphatic duct, they remain and multiply to the detriment of the organism. These wandering cells are of epithelial birth, and their relation to pathological new formations of the mammary gland does not in any way conflict with the assertion that all mammary neoplasms are derived either from the epithelial or connective tissue cells, and further, that such neoplasms are rarely, if ever, so far removed from the original cell type as to fail of recognition during at least some of the phases of their development.

Mr. Creighton, whose observations were made upon the mammæ of the bitch, but between which and the human breast there is a striking resemblance, believes these granular pigmented cells to be representative of a very low degree of mammary excitation, and hence liable to appear at other times than during the processes associated with gestation and the normal unfolding and up-folding of the gland.

To the presence of these large granular pigment cells is probably due many of the pathological new formations that have no other origin than an abnormal condition of the reproductive organs. This diseased state reacting upon the mammæ, there is caused a feeble and spurious evolution, followed by the same degree of involution, and with both of these processes the pigment cells are formed in abundance, as the product of mammary activity. In such cases the entire gland is probably at first involved, and contributes to the cellular proliferation which results so disastrously; but the disease is finally localized, sometimes in more than one spot, and the appearance of a local neoplasm presents.

A second method by which the waste cells give rise to pathological new formations, obtains when the granular cell

passes safely through the mucous canal, and is received into the lymph-sinuses of the lymphatic gland, but there, either because of the large size of the granular cell, or from some inherent defect in the glandular trabeculæ, is arrested at some spot in its stroma. From such a condition arises plugging of the sinuses and the medullary spaces, and consequent occupation of the entire gland by the waste cells of lactation. It is possible that the obstruction from either one of the two causes named, occurs near the hilus of the gland, for the afferent ducts are not equal in caliber to efferent tubes, and it is difficult to understand why, if the afferent duct remained free to remove all that passed into the gland, the obstructions which occurred in the stroma filter could not be overcome, unless of very considerable extent.

There is very little doubt that many tumors found in the inter-lobular tissue of the mammæ have their origin in obstructed mammary lymphatic glands, which when examined are found to have lost both efferent and afferent ducts, and remain as circumscribed isolated neoplasms, connected with the surrounding tissue only by means of vascular tubes.

The class of tumor referred to, as arising from the wandering waste cells of evolution and involution, the large granular pigment cells, are particularly concerned with the lymphatic tissues and glands. For, as a cause of abnormal development and growth, there is first a failure on the part of the absorbent to take up the waste cells, either because of actual disease of its function, or the limit of its capacity having been reached; and hence, the granular cell, possessed of inherent powers of multiplication, and being furnished with a nucleus, imbibes nourishment, taking to itself other cells, until, finally, a collection of cells is formed in the stroma of the gland, with possibly a wall, or capsule, constructed from the surrounding connective tissue.

The embryonic hypothesis of the origin of tumors quite recently advanced by Cohnheim, is of especial significance in the ætiology of mammary neoplasms. This theory in pathology should be placed in the same class with Mr. Owen's theory of parthenogenesis, and Mr. Darwin's theory

of pangenesis. Parthenogenesis and pangenesis are means of reproduction: from fertilized germs, in one instance; from cell-gemmules given off from cells before they have become formed, material, ready to be fertilized, in the other instance. Both theories are made to include a more or less remote gamogenesis. On the other hand, Cohnheim's theory does not include any method of reproduction, but is a pathological process from the beginning, and has to do with a retention of immature forms of cell life; it is not, however, certain that we can entirely exclude from the changes that conduce to the proliferation of these embryonic forms a spermatic influence. The lines between the previously supposed entirely distinct methods of reproduction, sexual and asexual, are gradually becoming less distinct, and it is impossible to say how much of the development of tissues is to be referred to an influence exerted by one cell, or group of cells, upon another cell, or group of cells; how much of this influence is exercised by the matrix upon the embryonal cell, neoplastic focus.

The theories of Cohnheim, Owen, and Darwin, while dissimilar, have this in common, that each one deals with germs that remain dormant in the system until excited to activity by some uncertain agent, and the conclusion seems natural that the embryonic theory of pathology finds its physiological prototype in parthenogenesis and pangenesis.

The evolution and late development of the mammary gland may be looked upon as favorable to the retention of embryonic cells in the undeveloped organ. For the mammary gland remains dormant during about one-fourth of life, the secreting cells retain an embryonic form until puberty, and it is within possibility that at least some of the neoplasms that develop in adolescence, and that are characterized by an embryonic histology,—the sarcomas,—have their origin in those cells left over from the formation of the gland. The neoplasms of later life are less likely to show such a genesis, for with the oft-recurring evolution and involution of the mammæ, any embryonic cell germs that may be in the gland before its unfolding are at such times liable to be discharged as waste cells, and

removed from a position where they could assume pathological proportions, and types.

As a leading principle upon which a knowledge of the ætiology of all pathological new formations rests, it may be asserted, "that all tumors, with the exception of the hydatid, are made up of one or more of the natural elementary tissues of the body, and that in no single example has any extraneous or new element been detected," and also, "that all tumors partake of the nature of the part in which they are developed, and are more or less made up of the elements which naturally enter into its formation." (Thomas Bryant.)

The conclusion to be drawn from this, that a neoplasm found to occupy a position where normally epithelium exists, has had its origin in epithelial tissues, and that a neoplasm situated in the connective tissue stroma of the organ, has arisen, however its mature development may differ from the parent cells, in the meshes of the connective tissues, and from connective tissue cells, is too broad and does not consider the possibility of diseased cells wandering from their birth place, and setting up in different tissues changes that result in their own nourishment and prolification. The differentiation of cellular elements which takes place in the germinal layers of the embryo, by virtue of which each layer gives rise to certain definite tissues and organs, is also the embryological histology of pathological new formations. For while, as Virchow has pointed out, there may be "histological substitution," that is, one tissue may, under the demands of functional activity, be replaced by an analogous tissue belonging to the same group,—for example, on the surface of the ventricles of the brain, there is first found ciliated epithelium, which later becomes the simple scaly variety, and also the mucous membrane of the uterus is usually covered with ciliated epithelium, but, during pregnancy, this is replaced by a layer of synamous epithelium,—there is no reason to believe that the cells of one tissue ever pass into or develop the cells of another tissue. Epithelium has not been known to develop connective tissue, nor connective tissue to give

rise to epithelial tissue. The extent and location of each tissue, is differentiated in the ovum, and there are no exceptions to the plan then begun (Billroth). When histological elements are found in a place where they do not belong, and are not in accordance with the organic conformation, they are developed in, not from, the elements that constitute the part, to which they gain access by their inherent ameboid motion. This endowment permits them to pass through the walls of bloodvessels and other tissues.

Aside from wandering cells as foci for pathological new formations, an apparent development of foreign elements is found in the infiltration of cells, by means of which cells have deposited within their walls, materials derived from the blood. Each cell, in undergoing this retrogression, assumes, even more than naturally belongs to cells, the function of a gland, for it appropriates to itself, and possibly, in part, manufactures material that does not belong to it. At the same time that this process is going on, excepting in the case of the amyloid and calcareous deposits, the physiological action of the cells is not wholly suspended. A mammary gland cell may become infiltrated with fat or with pigment, both of which conditions are physiological at certain periods in the history of lactation, indeed the former constitutes lactation, if by this is understood the production of milk, and hence furnishes additional proof of the physiological type of pathological new formations. But if either process, more especially the pigmentary infiltration, occurs at the wrong time, or beyond the limits of usefulness, the functional activity of the gland is not only interfered with, but in its place, is set up an abnormal action, having for its basis, cells developed for no definite end, cells that perform no function essential to the well being of the individual organism. Infiltration, as a factor in the ætiology of pathological new formations, is intimately related to the nutritive fluid, as a primary cause. For, although that which determines the peculiar nature of cellular infiltration is unknown, the initial cause resides either in the cell or the blood. In this connection, the principles of organic construction before enunciated,

the laws by which the abstraction from, or addition to the blood, prepares the formative embryonic mass for the development of organs in their proper sequence, furnishes a physiological type, for the processes that induce such changes in the blood, as interfere with the normal nutrition of certain cells. The origin of pathological infiltration is thus removed to some organ, possibly remote from the seat of apparent disease, and the whole question is reduced to one of nutrition. But it is questionable, whether the insufficient nourishment of cells does not precede their becoming infiltrated with a foreign material, for if the resisting power of the cell, the power by which the healthy organism is able to throw off disease, and appropriate to itself only that which will best serve its purpose, is not destroyed, infiltration cannot take place, beyond the limits assigned to it, and from whence comes the acquired cellular weakness, save through mal-nutrition? It would therefore seem, that the primary trouble, which later is followed by one of the varieties of cellular infiltration, resides in a systemic condition, which induces a local mal-nutrition, and that between this and the infiltration, there occur organic changes, which fail to perform the function of extraction, and thus certain properties remain in the blood, and are taken up by the cells, the resisting power of which is already weakened.

The power of the blood to produce other neoplasms than those which may be classed as infiltrations, probably occupies a secondary position, and it is not certain that to the nutritive fluid, belongs the, at least sole ability, to reproduce neoplasms, for it can no longer be held with the teaching of Hunter, to whom the cell was unknown, that the evolution of the embryo follows the development of the vascular system, the reverse, is nearer the teachings of modern embryology, and therefore, when there is an inheritance of pathological formations, or metastasis, or a tissue infiltration of the diseased cells, the blood cannot be regarded as the only agent, there being nothing in the blood to indicate its disease bearing qualities, save the histological elements of the disease, and if this is considered,

the blood is a conveyer, and the vessels the channels, which is not the sense here referred to. Secondary growths, while they may arise from entirely independent centers, almost always have their seat in cells that have wandered from the primary disease, and in this wandering, both bloodvessels and lymphatics, but especially the latter, are concerned as carriers of diseased germs and cells.

We have also to consider that cells possess independent action, by virtue of which they perform, or do not perform, their physiological function ; also, that action is inherent in vitality, indeed is inseparable from it, and the cell, as the material primarily recipient of life, represents in the most uncomplicated, and, therefore, perfect form, the qualities that distinguish life from death. This independent action of cells is obedient to the laws of use, and the breaking of these laws, has not to do with the physical state only, but has its origin in that which belongs to the higher forms of animal life, the will to distinguish between right and wrong. Positive science necessarily deals with material things, nor can this be otherwise with the physical instruments by which we work, but when it is considered that the essence of life, therefore of health, is something which pervades, but is not a part of the analyzable material, because it cannot be analyzed, that, without this something, the organism obeys the laws of dissolution—death—the origin of disease is removed from the histological elements to that sphere which controls the chemical compounds that form the material world. The extent to which constitution, that is the sum of the organic actions of the body, enters into the ætiology of mammary diseases, is difficult to determine, and this because of the untrustworthiness of statistics, but principally because of the changing types a disease manifests in its evolution—for there is evolution in pathology, as well as in physiology—and the fact that several generations may intervene between the appearance of a definite type of disease, in members of the same family. It is, however, evident that a constitution, in the sense of a state of the system capable of influencing the production of a new formation of tissue, may be either inherited or

acquired, and further, that the development of the constitutional characteristics, is directly connected with the nutrition of the cells, that diverge from the normal type. The question at issue among pathologists is, does the blood primarily contain the noxious elements of the dyscrasia, and convey these to certain tissues, in which, as a consequence, unhealthy action is induced; or is the disease primarily located in the cells, and the blood, being at first healthy, conveys proper nourishment to the diseased cells, but they are incapable of taking up or using their proper pabulum. That diseased blood, as such, is transmitted from parent to offspring, is opposed to all the known laws of development, and when it is remembered that disease is probably never carried, save by means of some form of cell life, and that the blood, before the manifestation of a disease yields nothing to distinguish it from healthy blood, and further, that the blood, save in the earlier days of embryonic life cannot reproduce itself, the corpuscles having no power of multiplying, but is supplied by a process of cell prolification, which takes place in other organs of the body, notably the lymphatic glands and the spleen; and also, that the blood and bloodvessels, appear in the course of embryonic development, which in itself shows that the blood is the nourisher, not the former of tissues, may be received in favor of the assertion, that whatever else may be the relation between the blood and a mammary neoplasm, either in an inherited or acquired dyscrasia, it cannot be the cause of the disease. That the blood may spread a disease when once localized, when organized, that is, when a disease has acquired such a degree of independent action, as to give rise to cell prolification, each cell being invested with the powers of the parent, cannot be doubted, but there is no reason for believing that the blood, for example, in a patient with carcinoma, before the development of the neoplasm, is unfit to nourish the body.

Between the constitution that transmits to an offspring a physical peculiarity, a deviation from the received symmetrical form for a body, and a constitution that transmits a

cellular deviation from the normal state, there does not exist so wide a difference as to place the processes in different spheres of causation. Any influence, or predisposition, that comes from the parent to the offspring, must descend through the germinal cells of the progenitors, and these are formed from the entire organism from which they spring. This character is not confined to any one element or tissue, but is possessed indifferently by the "small, round cells provided with large nuclei, which in uninterrupted accumulation form the germinal disc and the germinal area," and before the segmentation of the disc, into the three layers which later develop in the sexual parts and organs of the body. There is no reason to assert that, primarily, there is any difference in function between these embryonal cells, and, therefore, it cannot be said that physiological or pathological peculiarities are contained in any one group of cells. "A constitution should not be thought of as less than the sum of all those intrinsic things from which a whole health character is derived," and this whole character, and we would substitute physical for health, this whole physical character, be it for health or disease, is developed in the form of a predisposition to reproduction, the determining of which reproduction depends upon conditions not always inherited.

One of the most important causes in determining the reproduction of inherited dyscrasia, is age; sexual differences also should be considered. The periods of evolution, maintenance and involution, through which the entire system, as well as the mammary glands, pass, are connected with the sequence of the appearance of diseases, and, given the inherited dyscrasia, this requires only the proper age, represented by peculiar cellular changes, to develop and localize a disease. Of this there is abundant evidence in the development of carcinoma which is a disease of old age, and, moreover, localizes itself in organs that undergo the most marked degenerative changes, the mammæ and uterus. "Cancer is eminently a disease of degenerated tissues. We are wholly misled if we suppose cancer is a disease of healthy persons, whether by local degener-

acy or general; it is essentially a disease of degeneracy. It increases in frequency in proportion to the number of persons living as age goes on. The apparent exception to this rule is the very exception that proves the rule, for there are in women, without any analogues in men, two organs which enter into degeneracy, closely corresponding with the senile, at a comparatively early period of life—the breast and the uterus, and it is the predominance of cancer in the breast and the uterus that alone makes the greater frequency of cancer in the female than in the male. * * * It is solely this local degeneracy in women that makes them constitutionally disposed to cancer long before it would be likely to happen to men." What is true of carcinoma, may also be true of other neoplasms, each disease requiring for its localization certain cellular changes, which, though they may be brought about by external means, are generally dependent upon the phases of bodily development and growth, attendant upon age. And here let it be remembered, that the cellular position which the new formation holds, is not to be taken as representative of the age most favorable for its development, for it seems to be true of all pathological new formations, that the more closely they resemble embryonal tissue, that is, the nuclear undifferentiated cell, the more incompatible are they with health; carcinoma is the most malignant of growths, and this is a disease of declining life.

While it is probable that many pathological new formations are inherited, it cannot be asserted that a constitution capable of producing certain histoid growths may not be acquired. Have we not here the source from which dyscrasies spring? That acquired by the parent, if it enters so much into the system as to become constitutional, is transmissible to the offspring, and the same disease that was represented by a simple departure from the normal, may in succeeding generations acquire a wholly different type. Whether this can change its histological basis, is beyond present knowledge; from analogy it is probable that this does not take place, but an innocent growth may become malignant, and possibly a malignant growth may,

through successive filtering, become compatible with health, and eventually disappear.

We are now brought to a consideration of the origin of induced constitutional diseases. Without dwelling upon syphilitic diseases, which make up a large part of the acquired and transmissible diseases, we will study the morphology of the cellular changes that arise from some error within the system, that arise *de novo* out of the healthy working of the organism. Assuming that this is possible, and there can be little doubt that such an origin for pathological new formation does sometimes obtain, it is apparent that the pathological process must arise in the physiological working of the organism; that the abnormal cells arise directly from the healthy histological elements.

It has already been stated that all processes have their origin in previous cell life, the physiological as well as the pathological, but the period in the life of the cell, at which it assumes an abnormal form, is an important line of distinction between the inherited and the acquired disease. Those predispositious to cellular deviation from the normal that are transmitted through the ovum, even though they are not manifested until adult life, probably represent departures from one of the embryonic phases through which cells pass towards maturity, but this does not seem to be true of the acquired dyscrasia, for the parts most liable to generate unhealthy cell life, are those that are most active, hence undergo the greatest degree of change in the performance of their physiological function. Functional activity is cellular multiplication, and this cellular multiplication is accomplished by successive steps, corresponding to the stages of evolution from embryonic types, always, however, within tissue limits. Now it is probable, that cells are arrested at different periods of their development, to such an extent as to cause a departure towards a pathological new formation in the individual, without an inherited predisposition, but there is reason to believe that fully developed cells, or those which mark a distinctive period in the history of an organ or tissue, not infrequently have a disease superadded to them; that

the protoplasm of the cell may become infiltrated with foreign matter, to an extent beyond the limits of health; that in this state it is carried away from its natural situation, and hence deprived of the conditions that otherwise might be afforded for recovery, or harmless removal. The genesis of the cells showing a departure from the normal, may probably almost always be traced to the waste cells of nutrition. This is especially true of the pathological new formations that are developed from epithelial tissue. These waste cells, frequently waste only in relation to the organ from which they proceed, being endowed with vital activity and endurance, for they are nucleated, but with activity not under mature control, are easily affected by their environment and become hyper-nourished. Of this Rindfleisch says: "As the result of tissue change there are constantly being formed certain excretory products, which must be got rid of, not only from the tissues and organs in which they are produced, but also from the fluids of the entire body, if the processes of life are to go on without interruption. The substances take their chemical position midway between the organic nutritive bodies on the one side, and the excretory products of the kidneys, skin, and of the lungs on the other; they fall into the great gaps which exist in organic chemistry at this point. They vary slightly in each case from the different tissues, and on this difference rests the peculiarity of pathological new growths. If they are not properly transformed and excreted, they accumulate, first at the spot where they are formed, then in the juices of the organism, and this accumulation is the immediate cause of the setting up of the progressive processes which begin by a simple multiplication of cells in the connective tissue, and end by a formation of either tubercle, cancer, epithelioma, fibroma or lipoma." It may be questioned whether this position of Rindfleisch is tenable in entirety, whether there is any evidence to show that those pathological new formations that are incompatible with life, and which approach in their nature to the most elementary or embryonic structures, appear in the individual in which the first departure from health begins.

Pathological new formations originate—for even the inherited diseases have an individual beginning—in a simple change in the vital endowment of cells, and their malignant nature may be acquired through the individual influence to which the erratic cell proliferation is subjected as it passes from generation to generation. In this sense Virchow's emphatic teaching of the local origin of dyscrasias is deserving of profound attention. Each dyscrasia has a local origin, but this may antedate by many generations the individual in whom the dyscrasia shows itself. Each dyscrasia is also "dependent upon a permanent supply of noxious ingredients from certain sources," but this is not the origin of the dyscrasia, it is the continuance of it, and probably does not exist as an infecting center until the inherited predisposition has localized itself, which localization may represent the sum of the inheritance, and hence the future dyscrasia, as also its transmission, is made to depend upon the noxious emanations from the local source.

When, however, it is said that each dyscrasia has a local origin, there is still much to be desired if we would seek the origin of disease. It is evident that there is not a common source for pathological new formations; that while one may arise in epithelial cells, another may proceed from some error in connective tissue elements; possibly all processes are with propriety referred to malnutrition, but whence the malnutrition? It is not justifiable at present to trace all diseases that appear in the form of pathological growths to the cytogenetic organs, but there are many facts that point to the spleen, lymphatic glands and bone marrow as the organs in which the initial step is taken that is ultimated in an abnormal growth. To this source should be referred especially those formations that present premature cell types, and that approach more nearly embryonic cellular conditions; those instances in which the leucocytes fail to pass on to the more highly developed erythrocytes, or to be converted into permanent tissue elements.

The cells that in the breast form local centers for pathological growths—and in future we will adopt the belief that the origin of a dyscrasia is local, but that a dyscrasia can

be transmitted only as a constitution that becomes localized by individual physiological action—are, as has been pointed out, mainly the waste cells of secretion, the large yellow pigment granular cells; and of those cells that form in abundance during the lacteal process and which resemble colostrum cells, the ones attendant upon evolution and involution are the most fruitful sources of pathological new formations. The same cells from which mammary neoplasms arise, may also become the local irritant necessary for the development of a tumor dyscrasia, and later the local center for the supply of the dyscrasia.

The growths that have their origin in the connective tissue, resemble embryonal cells; and while it can not at present be asserted, there being insufficient data for even a confident prediction, the embryonic history of the connective tissue, and the office it fulfills in the economy, suggest that this tissue is largely concerned in transmitting diseases, possibly more so than the epithelial tissue; for if as Burkhardt maintained, the uppermost layer of connective tissue must be considered as the matrix of epithelial cells, the growth of epithelioma, which is frequently an inherited disease, but perhaps requiring a more excessive local irritant than other forms of carcinoma, as witnessed in epithelioma of the lips, is not opposed to the possible relation of connective tissue, to the inheritance of a tumor dyscrasia.

In speaking of connective tissue as the matrix of histoid growths, reference is made especially to the mobile cells of connective tissue. These cells are represented by the white blood corpuscles, and resemble embryonic cells, and "for each new quantity of connective tissue which arises, a certain quantity of embryonal connective tissue is required." They possess the power of self-reproduction, and this circumstance bears important relations to their pathological new formation properties.

The causes for deviation from the normal of connective tissue cells must be sought in the circumstances of their genesis, and their histological structure. As has been suggested by Rindfleisch, "the intermediary nutritive appa-

ratus prepares the lymphatic glands for the regeneration of its mobile cells." These cells pass through the walls of the bloodvessels and capillaries into the connective tissue fibers; they are wandering cells, and their arrest depends upon many conditions of the organism into which they migrate. Their structure fits them to take on a diseased action, for being embryonal they are naked, and hence deprived of the protecting envelope possessed by more perfectly formed cells; and also belonging to the formative tissues, to the stage from which development takes place, their tendency is rather to develop new forms than to multiply; moreover, mobile connective tissue cells belong to no special tissue, they have no definite organic construction to accomplish, but are indifferent cells, and hence liable to take on many forms of existence, physiological and pathological.

Though in no sense waste cells, the mobile connective tissue cells resemble the waste cells of lactation, in so far that both elements wander from their birthplace and enter parts where they do not belong. The universal presence of connective tissue in the body, and the evidence for considering that the connective tissue cells with their equivalents are the common stock of the germs of the body, justifies the conclusion that these mobile cells are a frequent source of new formation.

Thus far mention has been made only of the mobile connective tissue cells as concerned in the development of pathological new formations, and it is true that they chiefly give rise to connective tissue abnormal growths, but the stable cells, which are formed from the mobile cells, may under pathological irritations be aroused from the state that constitutes the connective tissue fibers, and which, unless disturbed, continue with but little change during the life-time of the individual, into a state favorable to the development of pathological new growths.

The condition of the connective tissue that precedes the development of tumors is in a marked sense one of inflammation, or, more strictly, irritation. Because of this irritation the blood is supplied in increased quantity, and

the mobile cells, becoming hypernourished, multiply rapidly. It may be received as incontrovertible that the more rapidly a tissue forms, the more quickly a cell passes through its various phases of development, the more frequent are pathological new formations; hence every attack of irritation of the breast is followed by a rapid multiplication of immature cellular elements. The multiplication of cells proceeds so rapidly that one "mass may perhaps be the parent of five hundred in the time which, in a perfectly healthy state, would be occupied in the production of two or three cells," and as a result a field is opened for the development of disease, especially if there is an inherited dyscrasia. Here it will be well to note the protecting influence exerted upon the cell by its membrane, or wall. This, which is probably formed from a thickening and induration of the outermost layers of the protoplasmic mass, acts as a filter, through which the nourishment of the cell must pass, and it is presumable that a discretionary power of some extent is exercised by this wall, by virtue of which noxious and foreign materials are prevented from coming in contact with the life of the cell. Hence the susceptibility to disease of embryonal cells, and the comparative power to resist disease, possessed by the matured cells.

The foregoing exhibits the relation between embryological and pathological developments, enunciated by Johannes Muller, and it is agreeable with this broad principle, that Mr. Bryant says: "All tumors are either simple or cancerous, innocent or malignant; the simple or innocent approaching in their nature the more highly organized natural structures of the body, even to the perfect glandular; and the malignant or cancerous simulating the most elementary or embryonic; for, as the normal tissues were formed from a single cell, and those of a higher grade from its development, so the cancerous element is a simple cell, or the undeveloped embryonic nucleus. In proportion, therefore, to the amount of the cell element in a tumor may its cancerous tendency be determined; and the greater the proportion of the fibrous or well developed structure, the greater the probabilities of its nature being innocent; the more a tumor

simulates the undeveloped cell structure, the greater the certainty of its being cancerous." In this Mr. Bryant uses cancerous and malignant as synonymous terms and descriptive of the class of neoplasms that will here be spoken of as carcinoma; but while a cancer is always malignant, and save in rare instances incompatible with life, all malignant tumors cannot be classed with cancers; the histological distinction, however, applies to all malignant new formations.

The transformation of an innocent mammary neoplasm into one that is malignant, and the necessary changes in cell type that would accompany such a degeneration, present histological difficulties that militate against clinical observation, and still it is a matter of general knowledge, that adenoid tumors pass into carcinoma, and fibroma into sarcoma, the latter so frequently that it has been questioned whether primary sarcoma of the mammæ is not a very rare neoplasm. We will find that a study of these tumors from every aspect leads to the conclusion that adenoma and carcinoma are not different diseases, neither are fibroma and sarcoma, but that they form the two great divisions in pathological histology, the epithelial and connective tissue neoplasms. That when adenoma changes into carcinoma, there is found another phase of the epithelial tumor disease; the same with fibroma and sarcoma, and the connective tissue neoplasms.

Embryonal cell forms have not been known to develop from more highly formed cells, neither does it seem consistent with observed phenomena, for a mass, or an individual part of that mass, to return to the undifferentiated condition of the embryo, which condition is a prototype of malignant histoid growths. The difficulty of reconciling the clinical with the theoretical and histological aspects of pathological new formations is overcome by accepting the general principle laid down by Virchow, that all new growths pass through a stage comparable to the undifferentiated cellular condition of the embryo. During this stage of indifferent cell-proliferation, as for example a fibroma, the already abnormally nourished and divided connective tissue cells,

cease to proceed to even the higher development of fibroma cells, and remaining as embryonal cells, are through the causes we have studied, induced to proliferate into some form of connective tissue neoplasm.

Pathological new formations are subject to the same degenerative changes that effect normal tissues. They inflame, suppurate, ulcerate and die, and in this tendency to inflammation is found a condition favorable on the one side to infiltration of surrounding structures and metastasis; and on the other side, a condition of self destruction. It is possible also, that inflammation precedes, in some instances, an infiltration of the cell itself, thus changing the primary character of the neoplasm.

The mode of origin of pathological new formation of the mammary gland may be embraced within three methods of cell proliferation, and these possibly have some bearing upon the future history of the neoplasm.

When there is an enlargement of a part by increase of one of the tissue constituents of that part, without addition to the original cell contents, or change in the character of the cell, simply an increased number of cells in a place where normally a certain less number exist, the condition is brought about by an imitation of a perfectly natural cell multiplication, division of the nucleus, which is the initial process in this division of the cell, and consequent multiplication of cellular bodies. Of this slight departure from health an example is found in the hypertrophy of fatty tissue, which frequently becomes circumscribed in the form of adipose tumors. The entire breast may also become hypertrophied, without representing more than hypernutrition.

From this simple cell proliferation may proceed other conditions of cell life that pass over into a more than simple growth, for with the rapid division of the cell which in itself invites disease because of the imperfection of the cell as an independent body, the cell may attain an enormous size before division takes place. This growth is due to an increase of the protoplasm of the cell, and also to division of the cell nucleus. These giant cells, which

frequently have attained their size by a process of endogenous cell formation, assume no definite shape, and are in a condition to receive harmful influences from more profoundly diseased cells with which they may be brought in contact, or to inflame, and thus lead to destruction, or to organize inflammatory products in which reside the foci for some new disease.

As a possible result of simple cell division as a mode of origin of pathological growths, infiltration bears an important part. Hypernutrition with abnormal nuclear division presents a favorable condition for the cell to lose its power of selection, and take within its walls constituents of nutrition injurious to its, the cell's, life.

Among mammary new formations, and the same will apply to all glandular neoplasms, is found a class of tumors that, while they resemble mammary glandular tissue, and construction, indeed are built upon the gland type, are clinically of more significance than simple multiplication of glandular epithelium would be. These neoplasms are an hypertrophy of epithelium, but they are more, they represent a spurious constructive force, and histologically are allied to one of the phases of evolution of the gland. These neoplasms are probably not growths from the gland; there is nothing to show that at any time, they have been connected with either ducts or acini, they are developed in the stroma of the gland, and are to be regarded as formed from the proliferation of secreting cells that have passed out of the acini. The adenoma are therefore a multiplication of glandular epithelial cells, but pathological from the beginning, in that the epithelial cells from which they have their genesis, having left the lacteal tubes, proliferate, building a mass of secreting vacuolated cells outside of the gland.

The third method by which pathological new formations are built up approaches more nearly the undifferentiated protoplasmic mass of the embryo, and represents a permanent state of the process that obtains at that period of life. To this class of histoid growths belong the most malignant tumors, those tumors which not only destroy

life by extending their characteristic cellular organization, but prevent nutrition and kill cellular bodies. Such a mass, when examined, appears as protoplasm without definite division, but only provided with nuclei. No cell walls are visible, even under a very high power, and the only change that has been observed as associated with an increase of the mass, has been a division of the nucleus. Such neoplasms may be either of connective tissue or epithelial origin. To the first class belong fibromata at one end, sarcomata at the other; to the second class belong adenoma at one end, and medullary carcinoma at the other. The epithelial neoplasms are always constructed upon the gland type.

The nearer a pathological new formation approaches embryonic processes, either in structure or in mode of cell proliferation, the more truly does its presence interfere with health, and the more liable is it to return after removal. It is not probable that failure on the part of a tissue to evolve higher forms of cellular life constitutes malignancy, or that the presence of embryonal conditions is sufficient in itself to destroy life, the cause of malignancy must be sought in the morphology of the new growth, in the demand its nourishment makes upon the system.

The history of development shows that each period toward the attainment of maturity is marked by certain outgrowths from the pre-existing matrix, and that the appearance of each again requires a peculiar nourishment, and, further, that this nourishment is prepared by the development of earlier periods of development. In early life, when the formative and constructive power is at its maximum, the embryo demands other food than that which the growing being requires, or, what is more applicable to the present question, the nucleated protoplasmic mass of the germinal disc is not fed upon the same proportions of food as the subsequently and maturer connective and epithelial tissue; and hence, if embryonic structures are retained in mature life and are sufficiently nourished to "produce itself from its own resources," the former being the most active, will take to itself the requisite food, at the

expense of the general supply of nourishment; and while this food is not fitted for growths, it contains the elements for maintaining nutrition. In this there exists a possible cause of the anæmia and general wasting which accompany malignant new formations, and this occurs in proportion as they resemble more or less the primitive cellular states or glandular structure.

The history of malignant growths shows an almost invariable multiplication of tumors resembling the original neoplasm, and this multiplication takes place not always in the structure at first invaded, but in the course of the absorbent vessels, and in the lymphatic glands. It is well ascertained that abnormal as well as normal cells are capable of propagation, and it is probable that the secondary growth of malignancy arises from the wandering cells of the primary tumor; these cells, as in the case of the waste cells, become arrested in their passage through the lymphatic trabeculæ, and there multiply.

The same takes place through the agency of the blood, into which the diseased cells pass, but whether the blood, considered as a tissue, is capable, aside from the diseased bodies which it contains, of spreading the original disease, we have already found reasons for questioning.

Of all glands in the body, and, with the exception of the uterus and ovaries, of all organs, the breasts, in their physiological life, present the most favorable and constantly recurring condition for the development of disease. This is not always in the form of pathological new formations, or of growths that continue after the exciting cause has passed away, but frequently begin and end in a simple hyperæmia. The changes that occur in the female breast at the time of puberty, are, if associated with such an unhealthy state of the reproductive organs as to cause irregularity in the establishment of the menstrual flow, well calculated to localize a constitutional disease, or to excite cellular changes in the gland.

Usually the passage from girlhood to maidenhood is made in safety, but it is not unusual to find the breasts swollen from sympathy with the inflamed uterus and ova-

ries. It is probable that at this time, and during each subsequent menstruation, there is a spurious evolution and involution of the gland, and if with this the irritation is sufficient to cause an increased supply of blood to the part, all the phenomena of inflammation may follow. This irritation is most favorable for the development of pathological new growths, for a constant condition of inflammation is an increase in the number of the white blood corpuscles, and these, as has been seen, give rise to the mobile connective tissue cells, from the rapid multiplication of which abnormal growths may result. This process at one end represents the primitive nucleated protoplasm; at the other end, the more highly organized tissues of the body.

At the final upfolding of the mammary gland, when all the organs connected with the reproductive system pass into a state of fatty degeneration, fatty infiltration, the lacteal organs are especially liable to develop those diseases which represent a formative power low in kind, not degree. This is the period of degeneration, and "with advancing age, the connective tissue stroma of the mamma preponderates, and, as it contracts, the lacteal glands, for the most part, atrophy and disappear through absorption of their cells which have undergone fatty degeneration. If, however, instead of passing through these normal obsolescent processes, the contracting fibrous tissue produces irritative changes in the epithelial cells, the latter increase actively and abnormally, and lay the foundation of tumors which are carcinomatous in 98–80 per cent. of all instances." (Samuel W. Gross.) Aside from the normal process of involution, through some individual cause or circumstance, the cessation of the flow of blood may be so sudden, and the condition of the blood, which was not prepared to dispense with the functional activity of the ovaries and tubes, such as to malnourish already irritated gland cells.

The diseases of the mammary gland admit of a division into four classes. The *first* class includes anomalies of development, both deficient and excessive; of these, only the latter claims especial mention in this treatise.

The *second* class includes diseases dependent upon the introduction of an animal parasite into the system.

The *third* class, diseases associated with the functional activity of the gland.

The *fourth* class, diseases characterized by an abnormal growth of the tissues of the gland, or by the development in the gland of cell masses, that in structure and arrangement are without physiological meaning. In this class belong the true neoplasms of the breast.

There is no absolute dividing line between the causes of the third and fourth classes. In many instances, one is the germ of the other, but in the first of these, it is designed to place those acute affections that arise from lactation, and reflex action of the reproductive organs, and which pass through their cycle rapidly, leaving no trace behind; while in the second it is intended to treat of the pathological new formations, whether these are benign or malignant. The diseases associated with the functional activity of the mammary gland have little pathological histology, save that which is dependent upon inflammatory processes, and the production of pus; but about the diseases of the fourth class centers the intensest interest of pathology.

Acknowledging the truth of the theory formulated by Virchow, that all pathological growths arise from physiological cells, and however they may differ in cellular elements from the typical cells of the body, have a prototype in physiological processes, we are obliged to discard the doctrine of absolutely new growths, and to limit pathological formations to the production of a structure at a point where it does not belong—*heteropia*—at a time when it ought not to be produced—*heterochronia*—or to an extent at variance with the typical formation of the body—*heterometria*. But a classification of neoplasms upon this basis involves complications that bring with them unnecessary confusion; for clearly, one neoplasm may be composed of a tissue foreign to the part in which the tumor occurs, and this tissue may also be developed at a time when it ought not to be produced. If, however, we regard neoplasms, according to the tissues from which they develop, the con-

nective or epithelial tissue, there are found two principal classes into which all tumors can be divided, classes as distinct and separate from each other as are the germinal layers in which the tissues have their genesis.

Neoplasms will therefore be considered under two divisions:

Neoplasms derived from connective tissue; mesoblastic tumors.

Neoplasms derived from epithelial tissue; epiblastic tumors.

CHAPTER I.

ANOMALIES OF DEVELOPMENT.

Each unit of life is maintained by virtue of its power to develop, and in proportion to its capacity for development, for the unit or organic combination of units that has attained its greatest usefulness and adaptation to cyclical needs, ceases to undergo the changes which constitute a rational conception of life. The existence, then, of such an unit depends upon its assimilative power, and when this grows weak and is no longer able to meet the demands made by waste and repair, when the force contained in nourishment is not adapted to the requirements of the decaying organism, the organism is broken up, and as a form of life is not recognizable. The development of the individual unit in the species becomes a step in evolution, and the same conditions found to be essential to the preservation of the individual apply with equal, if not additional force, to the life of the species. While, therefore, development is evolution, it is evolution restricted, the limits of which are found in certain structural forms more or less permanent, according to their use in the process of evolving perfect from imperfect modes of nature. *Mode* is here used in the sense of the definition furnished by Spinoza: "I understand by *mode*, an affection of substance, or that which is in some other thing, by or through which it is also conceived."

The expression perfect and imperfect nature, is open to criticism, because a conception of nature, using the word in its broadest application, and to embrace the cause, though unknowable, and its effect, which may be our environment, that excludes perfection, removes a fundamental principle of life—evolution—and there is no longer any substance, for substance exists by reason of its perfection, else there would eventually follow complete annihilation.

For perfection is the most complete use, the most entire adaptation of means to an end, and hence in its application to biology, perfection signifies that each unit performs its function, imperfection resulting when this is not done, and this imperfection constitutes the exception to the rule. From this it follows that perfect modes of nature do not of necessity represent the highest form of evolution, but rather the highest development of a unit, taking as a standard that form of development which is most conducive to the well-being of the species, and its greatest usefulness. In evolution there are, strictly speaking, no imperfections, each stage passed through towards the most highly evolved structures is in itself perfect, both as to its usefulness and its position in the scale of evolution, but the expression evolving perfect from imperfect modes of nature, is justified upon the ground that though each stable form is in itself perfect, it is not so when compared with the more highly evolved, and therefore more widely useful, forms of nature.

All life is based upon the establishment of an equilibrium between opposing forces, and as the opposing forces change and increase, as the environment becomes more complicated with the mutations incident upon existence ; a passage from the homogeneous to the heterogeneous, from simple to complex functions and structures, results, and constitutes evolution.

As substance must precede its affection, so it is found that the lowest forms of life are without structure, they are masses of colloid without cell wall, with requirements so few and simple as to be restricted within the boundary of receiving nourishment. Here it is plain that a complicated structure would be unnecessary, and hence the entire mass,

without regard to parts, performs the one function of absorbing nourishment and making it a part of its own substance. But with evolution there is a separation of the primal mass into organs, each of which performs a special function, and in proportion as the function is confined to the activity of one part, it is well performed; and while in the higher organisms there is a mutual dependence of one part upon every other part—a condition not observed in the lower organisms, where one organ or part may be removed without injury to the whole, and may even be perfectly reproduced—this mutual dependence is for the benefit of the whole, and enables that organism to preserve its individuality, as a heterogeneous form of life.

The number of organs is to be distinguished from the multiplication of organs, and it is a biological truth, that multiple organs are more subject to variation and anomalies than single parts; possibly this is because those parts that are single are more important in the preservation of the species than the multiple parts, and hence the latter may vary without causing any serious trouble. The hand, although composed of five separate parts, marks a higher evolution than the hoof, but this is an increase in the number of organs, an homologous organ becomes a heterogeneous member, for each finger is capable of a special usefulness. The mammary glands in the lower mammals are multiple, that is, several organs perform the same function, and, setting aside the law of adaptation to environment thus illustrated, of the provision made for several progeny at a single birth, the fact remains that one organ is a duplicate of the others, for there seems to be no difference between the lacteal fluid secreted by the several glands. Not only does this appear from analysis, but the glands are used indiscriminately by the offspring. Upon the principle of evolution annunciated, it may be questioned whether in the human species is found that perfect adaptation between the means of lacteal supply, and the usual product of conception that marks the most perfectly established equilibrium; whether a higher evolution would not be typified either by a double conception and birth, or if the rule holds

that now obtains, single uterine product and a single lacteal organ. In regard to twin conceptions it is to be remembered that the more heterogeneous the organism and function, the more limited the number of progeny, and hence we may conclude from analogy, as well as actual knowledge, that the highest forms of life, those that multiply by gamogenesis, are not only examples of homogenesis, or the necessity that for each individual there shall be a separate germ, but that normally one germ cell, the female element, is fertilized at a time, and further, that to accomplish this many sperm-cells, the male element, are required. For the present we will leave this subject, but its bearing upon anomalous mammary evolution will appear further on, when it will be considered more in detail.

Anomalies of evolution are deviations from the structure, and form of a recognized organic unit of an organism sufficiently adaptive to remain in harmony with its environment, until through the influence of the ever-operating tendency to perfection, that environment is so changed as to call forth a re-establishment of equilibrium. This equilibration is constantly in action, but so great is the elasticity and adaptive capacity of organisms, and so slow the changes in the environment, that the necessary gradations of structure are imperceptible, and are preserved only in those resulting forms that mark an adjustment, perfect for a period, but, from the essence of evolution, temporary.

Anomalies of evolution proceed from failure on the part of the germ cell, or the sperm cells, or of both, to establish the mutual adaptation necessary to reproduce an aggregation of organic units, similar to that from which the sexual elements are derived. That the meeting of the male and female elements is essential to the preservation of a species, that is to say, that sexual reproduction is not limited to the more highly evolved organisms, but occurs, sometimes at long intervals, in all forms of life, and is indispensable to the "perpetuity of generation," is a well established fact of biology, and points with emphasis to the germ cell and the sperm cell as the natural means of true, and therefore of untrue, or anomalous evolution. This brings the inquiry

to: *first*, How are the sexual elements acted upon, to diverge from the order of their life? and *second*, What are the forces capable of changing the germ and sperm cells? To forces in operation before these are brought together, must we turn for the causes of evolutionary phenomena, for, though the distinction cannot always be clearly established, those agents that are active after fertilization effect the unfolding of the germ, its development. The structure of the reproductive organs shows the male to be the giver and the female the receiver, and of the sexual elements, the germ and the sperm cells, this is equally true. The union of the sperm cells with the germ cells or ova fertilizes the latter, and it is from the ova, not the semen, that the new creature develops. It therefore seems probable, that the processes of reproduction are generated by the sperm cells acting upon the ova in a peculiar manner; that the female element is passive, the male element active, and that the latter's office is fulfilled, when it has set in operation the developmental processes. The nature of the action which takes place upon a meeting of the sexual elements, is one having for its object the equilibration of the two forces, and hence removal from the ovum of the conditions that oppose its development, and favor only its growth. From the mutual adaptation results an organism endowed with the power to establish an equilibrium with its environments, a power that continues until the equilibrium is accomplished, and action ceasing, the cohesion between the several units of which the organism is composed is broken, and the organism is dissolved.

Between the male and female elements of mammals and the higher vertebrata there is a noticeable disproportion in the number required for a single impregnation, and this disproportion is not without significance in reaching what can scarcely be more than an approximate knowledge of the individual functions of the germ and the sperm cells. Each germ that is fertilized results in the formation of but a single individual, and when in lower forms of propagation carried on by heterogenesis, where successive generations are unlike, through all the phases of a sexual

genesis there is probably the same phenomena, each ova,—and as before pointed out we are coming to regard these cells as endowed with less peculiar properties than formerly, and to recognize in them units that may at least in the lower animals become partially developed under other stimuli than the sperm cells,—develops but a single progeny, but for this single fertilization an almost countless number of sperm cells are required. Now it is not consistent with morphological knowledge, to believe that the power to awaken the developing process in the ova is increased in proportion to the number of sperm cells, but all investigation goes to show that each cell is a unit, and a complete representation of its kind, possessed of the full characteristics which distinguish it from every other cell. We are therefore brought to look upon the number of sperm cells necessary to meet the requirements of a germ cell to such an extent as to establish an equilibrium between the male and female forces, as bearing some proportion to the perfect reproduction of the new organism, not by virtue of their multiple fertilizing power, but because of the adaptation between individual sperm cells and the developmental centers of the ova, or it may be, organs into which the ova will develop. From this hypothesis arises the deduction, that the ova contains the germs or gemmules, from which it is possible to evolve various forms, and that the possibility for such development resides in the power of the individual sperm cells to call forth, by establishing a union with the germ for which it possesses a natural adaptation, the evolving process, which shall result in a perfect reproduction of the parent, or one in which slight variations are noticeable. From this it follows that perfect or true reproduction depends upon a complete union between the gemmules of the ova and the sperm cells, and that when this union is not complete, the resulting organism is deficient in some of its parts; and conversely, when the sperm cells, through circumstances of environment to which their generating organs may be subject, are collectively or individually adapted to establish a union with more highly evolved gemmules, gemmules that develop into organs with power

of renewed equilibrium, because of changed environment, are brought by sexual genesis in contact with ova containing such gemmules, a more highly evolved organism results. Hence the peculiarities of the product of conception seem to depend more especially upon the male.

Upon first thoughts, it appears as if this hypothesis did not explain the appearance in the offspring of characteristics peculiar to one parent, or the family of one parent, but it is probable that strongly marked characteristics of the ova, are susceptible of evolving by a process of pangenesis when not brought in contact with the sperm cells especially adapted to call into action their latent evolving power, and also, that between the sexes of a species there is sufficient adaptation for a strongly marked feature to be reproduced by a sperm cell not in perfect affinity with that characteristic gemmule.

We are now in a position to consider the nature of the germ and sperm cells. It has already been said, that the distinction between these cells and other cells of the body, are rapidly being done away with ; that it is no longer possible, in view of the phenomena presented by many plants and inferior animals in which "a small fragment of tissue but little differentiated, is capable of developing into the form of the organism from which it was taken," to hold, that the germ and the sperm cell have been "made by some unusual elaboration, fundamentally different from all other cells ;" but at the same time, it is probable that the cells that are capable of reproducing the organism, undergo changes not passed through by every other cell in the organism. Each cell of the body is possessed of independent life,and before it passes into formed tissue, throws off minute gemmules which remain dormant in the system,and may pass through several generations before they develop. In the lower organisms the development is brought about by the incident force of heat, or the redistribution of matter, resulting from contact with fluids of greater or lesser density, and each gemmule, or possibly group of gemmules, is capable of reproducing the whole organism, in proportion to the simplicity of the organism. In the more highly

evolved organisms, these gemmules aggregate at the reproductive organs, and constitute in their aggregated form the sexual elements ; hence the germ and sperm cell are composed of representatives of every atom of the body, representatives that need for their development to be satisfied by their sexual affinity of the other element ; if not so called into action, these gemmules remain dormant, even in the impregnated ovum, but passing on in an undeveloped state, may, through the same process of multiplication, transmit their descendants to succeeding generations.

The answer to the question, how are the sexual elements acted upon to diverge from the order of their life ? is now reached, for clearly, if the sexual elements are the resultant of all the forces of the body, it is through a disturbance of these forces that a rearrangement is brought about, and either each unit of the organism is not represented or it is more highly represented, or a part of the ova is not fertilized by the spermatic force.

The forces capable of changing the constituents of the germ and sperm cells may act upon any unit of the body, and, in general, may be said to belong to the domain of nutrition, for cells when over nourished multiply in excess of the required number, and conversely, when not sufficiently nourished they fail to throw off gemmules, hence the reproduction of a unit depends largely, if not entirely, upon the supply of nourishment to that unit. The relation, in animals that multiply by heterogenesis, between fertility and the conditions unfavorable to growth, that has been indicated by Mr. Herbert Spencer, is one closely connected with the supply of nourishment, for the "rapidity of agamogenesis is proportionate to the warmth and nutrition," and is a relation that has its origin, not in general nourishment, but in the nourishment of units, and this renders the organic units capable of multiplying, of throwing off such gemmules as are suited to reproduce their kind.

The conditions favorable to growth and unfavorable to fertility are those of hypernutrition, and may affect both the germ and the sperm cells. But the power to reproduce the organism does not reside in one element. The perfec-

tion of the offspring is also, and in great measure, dependent upon the perfect union of the male and female principles ; these are the forces which act upon the sexual elements, and produce anomalies of evolution.

The state of biology is not now such as to justify many positive assertions, but it seems quite reasonable, from the above premises, to regard the sexual elements as not in themselves male or female, or at least to look upon the ova as containing the elements of both sexes, and upon the determining power as resting with the sperm cells. This is in conformity with the hypothesis advanced by Dr. Knox, but he began with the embryo, and the unknown causes acting upon one or the other set of elementary parts are causes in operation in the uterus, and relate to the development of the parts already evolved. Now, if, as there is reason for believing, the germ and sperm cells are made up of representative gemmules from every part of the organism, and if the ova contains the elements of male and female, and, alone or in connection with the sperm cells, is able to reproduce the characteristics of a species generation after generation, the same course of reasoning leads us to regard the reproductive elements as containing also the gemmules of less highly evolved organisms. How else shall we explain atavism, as when more than a pair of mammæ are developed in man ? That the tendency to atavism may in time be lost, is supported by the generally accepted belief that disused parts finally disappear, and give place to the parts or organs of greatest usefulness in the economy, but the possibility of reversion continues an uncertain time.

There is probably a close relation between the sequence in which organs appear and their development, and it would be contrary to known natural laws to assume that the sequence is arbitrary ; the laws that govern nature cannot be otherwise than as they are. Throughout nature, lower forms appear as steps toward the accomplishment of more perfect forms ; and so in the higher forms, the parts that first appear in the course of development prepare, by elimination or addition, for the development of the parts that appear later. It is probable that this process of prepara-

tion is shared by all parts of the organism, but especially by the blood. For example, the peculiar condition of the blood which nourishes the germs of the lungs, heart, Wolffian bodies, etc., in mammals, may by reason of these physical processes be so changed before the end of the second month of pregnancy, as to be fitted for the nourishment of the germs of the mammary gland. These gemmules having been fertilized, are thus placed in a position to develop.

Taking the type presented by the human species, viz.: two pectoral glands, each provided with a single nipple, as the one from which to determine anomalies of mammary evolution, naturally deviations may occur in number and in situation in both glands and nipples; and it is also evident that numerically the glands and nipples may be above or below the normal standard. Hence are formed for discussion: *Supernumerary glands; Supernumerary nipples; Abnormally situated glands; Abnormally situated nipples.*

A. Supernumerary Glands,—Pleiomazia.

In proportion as the mind approaches to a conception of the essence of operative forces, it is removed from associating these with the idea of bulk or quantity, for it is perceived that each unit of power represents the whole power, and while it may not continue in operation as long, because a renewal of force is essential to existence, while it lasts it is as powerful as the whole. This is well illustrated by the anthropomorphism that found expression in classic Mythology; Diana, the moon-goddess and great mother, was represented with many symbols to signify these attributes. Her procreative power was frequently expressed, not by one phalus, but by phallic radii, and especially with the Ephesian Artemis or Diana, and also with the Isa of Northern Europe, the nutritive attribute was represented by a great many breasts arranged in rows on the thoracic and abdominal regions. The attributes of Diana being worshiped by means of contemplating her statues, it was

believed that the mental states thereby induced upon virgins and pregnant women, gave rise to multiple mammæ. More recently, supernumerary glands or nipples were thought to appear only in those persons who practiced the "black art." It was believed that to each such person was given a certain number of imps to nourish, and the "teats through which these imps sucked were indubitable marks of a witch." Concerning the first hypothesis, it may be questioned whether the alleged cause of multiple mammæ was not itself an exaggerated representation of anomalous evolution. The second, is a record of ignorance, and therefore superstition, both of which belong to a system of ecclesiastical intolerance.

Compared with other anomalies, the appearance in man of more than the normal number of mammæ cannot be considered as a very rare deviation from the general formation type. The anomaly has been most frequently observed in women, but Dr. Petrequin saw a man with three distinct mammæ, two on the left side, the supernumerary gland being situated above the normal one. This man had five children, three sons and two daughters. The sons presented the same anomaly as their father. The two daughters were also tri-mammal. Their daughters were married, but their children presented no such anomalies.

The position of supernumerary mammæ is subject to considerable variation. M. Gorré mentions a woman who had five breasts. Four of these were prominent and full of milk, each having a large nipple, well raised and surrounded by a dark areola. The fifth breast was small and did not seem to be influenced by pregnancy. Two breasts were situated on each side, one above the other ; the fifth occupied a position about four inches above the umbilicus. An aged women residing at Psullendorff, Germany, had four mammæ, two on each side. M. le Docteur Gardeur mentions a mulatto woman who had two breasts in the normal position, and two others situated near the axilla.

Mammæ have been found on the back ; and M. Roberts reports a case of one on the left thigh, from which the mother nursed her children ; this gland appeared as a

simple nævus until the woman became pregnant. The mother of this woman had three breasts, all of which were situated upon the chest. M. Jussieu reports the case of a woman who had a third breast in the groin, from which lactation was performed. A case was reported in the Dublin *Quarterly Journal of Medical Science*, 1848, of quadruple mammæ. There could not be found any ancestor who had suffered the same anomaly, and this woman was not aware of the adventitious glands until the natural enlargement attendant upon pregnancy took place.

It is not unusual for the anomalous organs to remain unnoticed until pregnancy, but when the nipple is developed this alone would lead to a detection of the true condition at an early age. The supernumerary glands are not always provided with nipples. Mr. Champion mentions a case in which the anomalous breast was situated in the axilla and had no nipple, but upon pressure the milk exuded from six small tegumentary openings. This is probably the case in all instances in which there is no prominent elevation for the nipple, and it may be questioned whether if an attempt was made to draw out the nipple, as by the suction of the child, one would not be developed.

It seems difficult to discover the law that determines the situation of anomalous mammæ, or to form an hypothesis in explanation of the cause of the abnormal placing of the gland. For if, as it is probable, each organ or sphere of the organism is contained as a germ in the germinal layer out of which it is developed, and if the developing powers of the germinal layers are not interchangeable, and also if the conformation of the organism as a reproduced image is determined already in the ovum, how is it possible for a mammary gland to appear in the groin, for example, or on the back? Embryology and biology furnish the most satisfactory answers to these questions. The essential part of the mammary gland, the secreting structure, is epiblastic; the basis substance, the stroma, is mesoblastic. The derivatives of both of these layers are found whenever the mammary glands are

developed. The initial step in the development of the mammæ resides in the epiblast, as a growth inwards from the epidermis and the development of a mammary gland in an abnormal position may be looked upon as arising from misplaced gemmules, germs that in the epiblastic layer have failed to aggregate at the spot where the normal mammæ are found.

There is apparently some regularity observed in the situation of the supernumerary glands. They are generally symmetrical, and when there is an uneven number, the odd gland appears on one side, for it may be questioned whether in the case of five breasts already referred to, the fifth gland was situated on the median line; it is more likely to have been placed on one side, towards the median line. This symmetrical arrangement will at once suggest an analogy with the multiple glands of lower animals, and also the position in which there is usually an accumulation of fat, or the presence in early life of the fat bodies. Hence, there is support to the hypothesis that refers the situation of supernumerary mammæ to atavism.

I am not aware that a supernumerary gland in the human species has ever been found in a position that does not correspond to the position occupied by a normally developed gland in some animal lower in the mammalian scale. The gland situated on the back is perhaps an exception, but here there is an approach to aquatic mammals, whose mammary organs are nearer the dorsal than the ventral aspect of the body.

Cases of triple and quadruple mammæ occur with nearly equal frequency. M. Isidore St. Hilaire states that tri-mammæ are the most frequent. It has been suggested by the same savant that when the supernumerary mammæ are situated laterally, they give milk, but not so when they occupy a position on the median line. As before observed, the latter situation is open to the criticism of mistaken diagnosis, but even this situation has an analogue in certain marsupials, but the majority of mammals have glands situated on either side of the median line, and these are furnished with nipples.

Supernumerary mammæ are sometimes the seat of severe pain and even inflammation; especially is this the case when the means for discharging the gland contents is inadequate. They may also be the seat of any one of the diseases that attack the normally developed breast, and are, perhaps, from the fact that the organ is a departure from the order of the body, and therefore in itself an abnormal product, more liable to take on a diseased action.

TREATMENT.

In the majority of instances, the abnormal gland will require no treatment, but it is evident, from what has been said of the occasional situation of these organs, that surgical interference becomes at times advisable, if not absolutely necessary; for if the breast occupies a position where it is liable to more than the usual risk of injury, or a position where it will interfere with the natural performance of other functions, in consideration of the susceptibility of these glands to become diseased from slight causes, and the uselessness of the multiple glands, without strong opposing reasons it is well to remove the gland as early as possible after its discovery.

The adventitious organ is usually imperfectly developed, and unless forced into activity rarely performs the full lacteal function, and this very fact predisposes to disease, for sluggish action of a gland results in the incomplete evolution of the function, and hence an accumulation of cells that have but imperfectly passed through their changes towards lacteal cells, and these imperfectly evolved cells are extremely liable to disease. It therefore seems advisable, if the subject is a female, to amputate the breast whatever may be its situation, before the establishment of menstruation. This is evidence of a negative character, but there is reason for believing that the locating of a malignant disease, has been averted by following the rule of early amputating an adventitious mammary gland.

The operation is one of extreme simplicity. The surgeon with his left hand, makes tense the integument that covers

the adventitious organ, and with a stout scalpel makes two elliptical incisions, or a single straight incision, of sufficient length to permit a clean dissection of the glandular structure from the tissues in which it lies. The incision should be given such a direction, that its lower end may serve to drain the cavity of the wound. With the scalpel handle if possible, the gland is then dissected out, and the wound closed with silver wire sutures. Or it may be advisable if the gland is small, and situated where the integument and tissues are loose, as in the groin, to operate by making two incisions, that shall include between them the gland. This operation reduces the granulating surface, and hence favors union by first intention. The subject of drainage and the dressing of wounds of the breast, will be more fully considered, under "Amputation of the breast," but I will here say, that pressure over the cavity is a matter of the first importance, and after the removal of an adventitious gland, which operation is much like that for excising a small tumor, is frequently the only dressing that will be required, if there have been made sufficient provision for drainage of the wound cavity.

B.—Supernumerary Nipples.

The development of more than one nipple for each breast, is not as rare an anomaly as supernumerary glands.* The two deformities are probably different expressions of the same abnormal constructive force, but it is also probable, that the origin of multiple nipples is not in all cases an error of evolution, for whatever may be the process of development of the mammary gland, whether from the surface inwards, or the reverse as maintained by Mr. Creighton, the nipple into which each lobe of the gland enters, and through which a communication is established between the interior of the gland and the surface of the body, marks a point at which a certain number of lacteal ducts converge to empty their contents and is, even in normally developed

* Instances of fifed nipples have been observed, the opening of the milk duct occupying the apex of the cleft.

breasts, more or less accidental. Hence wherever these ducts converge in sufficient number to require an outlet, the integument will be elevated into a mammilla.

It is possible that each mammary gland, or more accurately, each congeries of mammary glands, must be supplied with an opening of this kind, and therefore, strictly speaking, it is a misnomer to say that a gland possesses more than one nipple, for if the number of nipples corresponds to the number of glands, the breast is composed of as many glands as there are nipples. Hence the anomalies of supernumerary glands and supernumerary nipples, seem to differ in this respect, the position of the abnormally developed gland.

Generally the supernumerary nipples are well developed, though the supply of milk is not usually as abundant as from a breast with one nipple. Seven nipples were observed on one person. This person had two pectoral breasts, five nipples on the left, and two on the right side. They all gave milk, and the woman who was a nurse, was so greatly inconvenienced by the flow, that she applied at one of the London Hospitals for relief. Jean Borel mentions ten nipples on one breast. There seems to be no regularity either in the position or number of the supernumerary nipples.

Closely associated with supernumerary nipples are the pedunculated bodies sometimes found growing from the side of a normally developed nipple. Mr. Brikett mentions a case of this kind, and I have met with several. The growths resemble nipples, with the exception that they are not penetrated by a lacteal duct. They generally grow from the base of the true nipple, or from some point within the areola. The most serious inconvenience arising from these growths is connected with nursing. They are in the way of the child's mouth, and should they be taken in the mouth with the nipple, are very liable to be injured, and be a source of much pain and suffering. Therefore these pendulous bodies should be removed as early as detected. They may be snipped off with scissors curved on the flat.

TREATMENT.

Supernumerary nipples may become very troublesome during lactation, and for this reason, and also because they constitute a deformity, may sometimes call for treatment at the hands of a surgeon. The only effective means of treatment is to remove the abnormal growths with either the knife or scissors, but it may be questioned whether this is advisable, for if the opening by which the secretion of the gland is excreted is closed, and the gland becomes functionally active, the accumulated lacteal fluid may be productive of serious results. Possibly the gland belonging to the adventitious nipple could be removed, but the dissection would be very tedious, and danger of injury to the other parts of the breast almost certain to follow. If the nipples are discovered before puberty, this, however, is not always the case, they may be removed with impunity, judgment being exercised in deciding which prominence it is best to amputate; of course this should be that one that is the least developed.

This practice is based upon the principle that the part of the breast belonging to the removed nipple will not develop in proportion to the other parts of the organ, and hence at the period of lactation the principal if not the entire function of lactation will be performed by the whole gland. It has occurred to me that possibly the secreting surface connected with the adventitious nipple could be rendered functionally inactive by injections of some irritating agent through the nipple into the gland, before the age of puberty, but here, as in every surgical operation, the surgeon must use his own judgment to decide whether the advantages gained are commensurate to the risk encountered. The removal of supernumerary nipples is best accomplished with a pair of scissors curved on the flat. The nipple should be drawn well forward with a vulsellum, or pair of strong-toothed forceps, and the scissors applied close to the integument covering the breast. If vessels are cut and give rise to troublesome bleeding, they should be tied, and if any considerable gaping remains at the seat of

the nipple after its removal, the edges should be brought together with metal sutures, otherwise a lacteal fistula may remain.

CHAPTER II.

DISEASES THAT DEPEND UPON THE INTRODUCTION OF AN ANIMAL PARASITE INTO THE SYSTEM.—HYDATIDS.

It is probable that the lowest form of animal life hitherto observed is the habitation of some still lower forms of life.* Even the lowest protozoon, a mass of homogeneous gelatinous matter, on the confines of the animal kingdom, may harbor some more primitive form of life than it represents. To this hypothesis it may be objected, that as the animal kingdom has for its apparent beginning a simple mass of structureless matter, therefore it is illogical to suppose that the elementary particle contains within it forms of life nearer the source of the animal kingdom, but may it not be, that where there is the beginning of animal life where Zoology has its origin, the vegetable parasites live upon the animal organism? There would thus seem to be no limit to the feeding of one form of life upon another form of life.

Animal parasites are low forms of life † which, during a part or the whole of their existence, live upon (*epizoa*), or within (*entozoa*), some more highly organized animals. They do not form a special class in the animal kingdom, but belong to all its classes, with the exception of the mammalia. They are found most frequently among the articulata.

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* The definition of life given by Mr. Herbert Spencer, though acknowledged by its author to be inadequate to present an adequate conception of life, is the most satisfactory at present formulated: "A definite combination of heterogeneous changes, both simultaneous and successive, in correspondence with external co-existence and sequences." Principles of Biology. Vol. I., p. 74.

† The *Gregarina*, a species of microscopic parasite that infests the internal cavities of some insects and worms, is a mere cell, without perceptible organs; so also is the *Distoma tarda*, found in certain fresh water snails.

Prof. Louis Agassiz describes three orders of animal parasites: I. Protozoa. II. Vermes—*worms*. III. Arthropoda. The second order,—Vermes, will here properly engage our attention, for a certain stage in their process of generation, constitutes some very rare affections of the breast.

Intestinal worms are found in the majority of animals, though some animals, and the inhabitants of certain countries, seem to be notably infested with these parasites. Mr. Owen gives eighteen as the number of intestinal worms that infest the human subject, and of these at least fourteen are well established species of entozoa. Heller increases the number to twenty-one, and Cobbold gives ten as the number of tape worms that invade the human body. In Iceland, every seventh person is said to suffer from the larvæ of the *taenia echinococcus*, a tape worm that infests only the dog and wolf. Persons who use pork extensively as an article of diet, or those persons who are engaged in the breeding of swine, are liable to become infested with the *taenia solium*, or the *trichina spiralis;* one parasite inhabits the intestines, the other the flesh of hogs. Men become infected with *taenia mediocaneleata* from eating veal and beef, in which the larvæ of this worm sometimes live. Certain species of fish, notably those belonging to the salmon and trout family, harbor the larvæ of the *bothriocephalus latus*, and man becomes infected from eating the flesh of such fish. The ova also find their way into water, and by such means gain access to the stomach of human beings. The lower animals are rarely the host of this parasite.

Tape worms, or cestoda, multiply by a process of heterogenesis, the successive generations being unlike. Their genesis is a sexual, with sexual genesis recurring at intervals, or to follow Mr. Spencer's phrasing, "agamogenesis, interrupted more or less frequently by gamogenesis." Each generation, whether this results in the formation of a single individual, or organization around several axes, represents a distinct phase in the development of the mature tape worm, and generally requires for its host, an organism

different from that required by the preceding phase or generation.

Beginning with a sexually mature creature, which may be either androgynous, or with sexes separate, the ova give rise in another host to organisms wholly unlike their parents, and these though sexless, give rise to still others, which are dissimilar from their parents, until reaching the proper host and surroundings, there is developed a sexually mature organism like the first progenitor. This cycle of existence as Mr. Owen has remarked, is not a metamorphosis but a metagenesis. It is an alternate generation, in which several stages in the life of an individual are represented, but these stages are peculiar, in that the individuals while thus existing, propagate asexually, by gemmation.

A sexual reproduction, the power to propagate without a union of the germinal elements, that is multiplication by sexless creatures, is not without limit, for as we have seen in the preceding chapter, the ability to multiply by agamogenesis, depends upon the impetus given to the entire organism, by gamogenesis. It therefore is not a question of whether this takes place, but of how it takes place. Two theories have been advanced in explanation of asexual genesis, and alternate generations. Mr. Owen has suggested, "that not all the progeny of the primary impregnated germ cell, are required in constructing the tissues of the new animal, but that some remain in the animal unchanged, ready under the favorable circumstances of light, heat &c., to repeat the same process of growth by imbibition, and of propagation by spontaneous fission as those to which itself owed its origin." Mr. Darwin, in his theory of Pangenesis, gives wider range to gemmation or spontaneous fission, and also includes within it sexual reproduction, for not only do the gemmules aggregate at the reproductive organs, but also, as in lowly organized creatures where heterogenesis obtains, at different parts of the same organism where a union taking place with an affinity, a bud, the beginning of a new individual, is formed. Hence to constitute a new creature, becomes a question of development, for, and this holds true of all organized beings, as soon as a part becomes able to

carry on independently, the process of nourishment to an extent sufficient to maintain life, that part will be separated from the parent structure; a little reflection will make it evident that this applies even to the oviparous and the viviparous processes.

The sexually mature worm, is composed of a head and segments, *proglottides*, which together constitute the *strobila.* The anterior segment or head, remains barren, those of the neck and body are sexually immature, and only the caudal *proglottides* are capable of becoming independent of the *strobila*, these contain the ova from which are developed the embryos, *proscolias*, which in turn become changed into nurses, *scolices*. This latter phase in the development of the tape worm, represents the cysticercal state, the common hydatid. The sexes are separate, or one, (*taenia echinococcus*) or more, (*t. solium*) of the proglottides is each provided with a complete sexual apparatus, consisting of both male and female generative organs, which in comparison with the size of the parasite, are developed to an extent unknown in other animals. In some instances, the proglottides are self impregnating, in others, probably impregnation is accomplished by the union of two segments. The mature ova, either escape from the uterus before the segment in which they are developed is detached from the head, by bursting of the uterine walls, the vaginal orifice being too small to admit of the passage of the ovum, or by spontaneous fission, the mature proglottis becomes detached, and passes out of the intestines with the excrement. The proglottides may then be ruptured and the ovum set free, but more frequently the segments in continuity, are introduced into the stomach of another animal, or host, with his food, and there by the action of the gastric juices, dissolved. In the stomach, the ova develop a number of hooklets, with which they penetrate its walls, and thus gain access to remote parts of the body; or the ova enter the bloodvessels, or lymphatics (Virchow) and so migrate passively, from the point of their introduction.

The embryo, when it has gained a situation that furnishes

the essentials for its future growth,—if through chance it is carried elsewhere it dies,—excites in the surrounding cellular tissue a degree of inflammation, by which a dense cyst wall is formed at the expense of the structure in which the parasite is lodged. This is the cyst worm, the larval state of the cestoda, which only requires to be introduced into the stomach of a third animal to be there developed into a true strobila.

A single parasite is found in the breast. This is the larvæ of the *tænia echinococcus*, which forms the hydatid tumor of authors. The grounds upon which Küchenmeister distinguishes two species, *e. altriciipariens*, and *e. scolicipariens*, seem quite insufficient to justify such a division, for both are the larval state of one worm, *taenia echinococcus*, their only difference consisting in the separation or nonseparation, of the young echinococcii from the parent cyst, and the number of hooklets that they possess ; these differences are probably referable to the age and the conditions of the development of the parasite.

The *taenia echinococcus* is one of the smallest of intestinal worms, but in its larval state, is one of the most injurious. In the strobila condition it infests only the dog and wolf, but its larval state constituting the hydatid tumor, is of frequent occurrence in man. Cuvier had not seen this entozoon, and therefore he doubted the existence of both the larvæ and the mature worm, but its existence as a distinct species has been incontestably established by the researches of Leuckart, Van Benden, Van Siebold and others.

The sexually mature worm is composed of a head and three or four segments. The last proglottis, which greatly exceeds in size the remaining portions of the body, is the only one provided with sexual organs, and according to Leuckart, is self impregnating, but Cobbold has brought forward anatomical peculiarities that seem to indicate a separation of sexes.

The embryos after escaping from the uterus of the proglottis, gain access to the stomach of man with his food, or by contact with the infecting animal. From the stomach

they burrow their way, or are carried to some distant organ usually the liver, though no organ in the body is exempt from their invasion.

The cysticercal form of the taenia echinococcus, is a cyst composed of two layers; the outer layer, the ectocyst, is structureless, consisting of a substance closely allied to chitine; the inner layer, the *endocyst*, Mr. Huxley regards as the vital element of the animal, the structure from which the buds spring. This hydatid, unlike the cysticercal form of other tape worms, retains its spherical form during life, and at a very early period becomes surrounded with a capsule of condensed connective tissue, developed from their host. The sac is filled with a clear yellowish fluid, sometimes bloody, having a specific gravity of from 1007 to 1015, contais no albumen, and only a small proportion of succinic acid, but is rich in chloride of sodium.

After quite a lapse of time, the daughter vesicles are developed from the endocyst, and from the daughter vesicles, at least in man, the scolicis are developed. Occasionally there is only one daughter vesicle, in which case no space is left between it and the primary vesicle, or there may be many vesicles, each containing small cyst-worm-heads. The scolices in health, are always attached to the vesicle from which they germinate; when found floating about in the fluid contents of the cyst, the condition is a morbid one. By a process of eversion, the scolices can be protruded from that portion of the endocyst that forms the wall of the brood capsule, but during the life of the animal, they are usually retracted. Small highly refractive calcareous concretions are found in the parenchyma of the cyst wall, which may be considered as the first evidences in zoology, of a cutaneous skeleton.

The primary cyst varies in size from that of a pin head, to that of a child's head, and firmly adheres to the enveloping cyst in all its parts. In very large cysts, the parent vesicle appears to be wanting, either it is mixed up with the young vesicles, or else disappears from the excessive attenuations to which it is subjected, by pressure within its walls. The enveloping cyst, is generally somewhat thicker than

other cysts similarly formed, apparently made so, by an abundance of proteinous unorganized substance. The thickness of its walls renders the nourishment of the young parasite rather difficult to explain, but the fluid that the cyst contains, and upon which the animal lives, is probably secreted by endosmose, but so small are the pores through which this process is carried on, that they have thus far eluded observation.

The echinococcus cyst proliferates throughout its whole extent, and the first indication of what is to be an echinococcus head, is a "slight papilliform elevation at the inner surface of the endocyst." In some instances this daughter vesicle, or capsule, becomes detached from the parent cyst and floats freely in the contained fluid; in other instances, a long pedicle remains, through which a communication is maintained between the vascular layer of the primary and secondary growths.

Generally the echinococcus continues to live and proliferate for years, but it is subject to calcareous degeneration, and ultimately the whole vesicle is converted into a limy mass. Women are more liable than men, to be affected with the echinococcus diseases, though the reason for this susceptibility has not been found. Men are usually attacked between their thirtieth and fortieth year, women somewhat later.

Hydatid of the breast, is a very rare disease, and though its existence has been doubted, several attested instances of the occurrence of the larvæ of the taenia echinococcus in the gland, place the question beyond doubt. It is probable however, that some of the cases diagnosed as hydatid tumors, have not been really such, but some other variety of cyst, in which the parasite, the only positive diagnostic sign, has not been demonstrated, but assumed to be present.

I am not aware, that the disease has been observed in unmarried women, (Dr. Warren mentions a case of what he calls "Incipient hydatidal tumor of the breast," the cellulous hydatid of Sir Astley Cooper, as occurring to an unmarried woman.—Surgical observations on Tumors, page

207. But it may be reasonably questioned whether this was a true example of echinococcus. The gland "was filled with little cysts," but these are not said to have contained the characteristic scolices.) or in the breasts of men. The larva gains access to the breast either by means of the circulation, the most usual method of transportation, or by establishing a communication through the chest or abdominal walls, in which case the mammary trouble is in connection with the same affection in more deeply seated organs.

Hydatid of the breast, begins as a swelling, unattended with pain, though Mr. Brikett reports a case in which a few months after the appearance of the tumor, the breast became quite painful and sensitive to the touch. The tumor is hard but not movable under the skin ; at first its surface presents no unevenness, but later nodules may be felt through the skin ; when the sac is very large, it retains its smoothness. The skin covering the tumor remains unaffected until the cyst has attained a considerable size, when the pressure from the increasing fluid, causes interruption in the blood supply of the integument. The general health remains unimpaired and the lymphatics are not affected.

The tumor sometimes attains an enormous size: Sir Astley Cooper describes one that weighed thirteen pounds ; this however is exceptional. The tumor may remain small for years, when, without any assignable cause, a sudden enlargement takes place, though even then it is rarely attended with more inconvenience than its size would naturally occasion.

The disease has not been known to attack both breasts ; the right is equally susceptible with the left.

In some instances, hydatid of the breast has been attributed to an injury, but it is improbable that mechanical means could produce any form of an entozoon ; it is probable that the injury has first directed the patient's attention to a disease that already existed, and that depended upon no local cause, unless it may be said that the larva was arrested when it found the desired nourishment.

Hydatids occur in the breast under three forms, A. *The single cyst, which proliferates endogenously, and contains one or more daughter vesicles and scolices ;* this is an example of internal metagenesis. This variety may attain an enormous size, and is scarcely distinguishable from other cystic growths before an examination of its contents. It generally fluctuates in all its parts, and when large, is intensely hard and elastic.

B. The multiple *echinococcus cyst*, in which many small *cysts are situated in the dense connective tissue of the breast*, and thus displace the gland structure. Probably in the stroma of the gland the majority of growths not arising directly from the gland cells, are situated, and in this structure the larvæ of the tape-worm are carried and most frequently rest, for here they find an elastic and yielding tissue, and one from which they can derive the necessary external covering. Until Virchow discovered the animal nature of this tumor, it was classed with colloid growths. This variety has been most frequently found in the liver, but some of the cases of hydatid of the breast may be included among the multiple cysts. Their mode of growth seems problematical. The theory has been advanced, that these tumors originate from a single larva that has failed to form around it a firm cellular tissue sac.

With the increase in the size of the cyst, the latter is forced in different directions, and ultimately these divisions of the cyst may become separated, making as many distinct tumors. This variety of parasitic disease of the mammæ seems more truly a disease than the other varieties, for however the cysts may multiply, they are a deposit in the already diseased tissue.

The multiple echinococcus tumor is diagnosed by its unevenness of surface, and soft fluctuating spots, that may be detected in a hard tumor. The health is not impaired, and until the disease is well advanced the integument covering the tumor remains natural. Then it may ulcerate, and fungous granulations of large size generally spring from the opening. It resembles scirrhus in which cysts have developed, but the unimpaired health will generally

aid in reaching a correct diagnosis, certainly in determining whether the growth shall be considered malignant or not.

C. *The single cyst, one that has become unable to support life within its walls, and in which only the remains of the parasite are found.* This is the barren cyst, the acephalocyst. The exact nature of the growth has been a matter of doubt. Mr. Owen suggested that it was "a gigantic or giant cell," and thought that any cell growing to such a size as to be recognized by the naked eye should be called an acephalocyst. It is now, however, well established that these cysts are of parasitic origin. Their objective features do not differ from those of the variety first described.

The diagnosis of hydatid of the breast is attended with difficulty. In the early stages of the disease, when small, and hard, and presenting none of the cystic features, it resembles scirrhus, for which it has been mistaken, When the cyst increases in size and fluctuation can be detected, the tumor resembles any other cystic growth. In making a diagnosis, the most importance should be attached to the unimpaired health of the subject; the situation of the tumor at the outer and upper border of the breast, not near its nipple; the non-inflammatory appearance of the integument, veins and glands, even though the cyst-walls ulcerate; but above all these, the fluctuation, which establishes this much, that it is a cyst, and the "hydatid fremitis" of Piorri, a sound arising from the motion of the free scolices, within the parent vesicle; this positive diagnostic sign is, however, rarely obtained. In most instances it is impossible to determine the exact nature of the tumor before an examination of its contents is made.

TREATMENT.

The hydatid tumor contains the elements of its own destruction, for the extent to which the primary vesicle may be distended by the development of other vesicles internally, is limited, and the inflammation resulting from the irritation of the parasite may destroy the cyst, and thus liberate its free scolices, but the disease is not thereby erad-

icated, for the scolices are capable, when passed to other parts of the system, of forming new enveloping cysts, and hence of repeating the primary disease. Possibly in this spontaneous rupture of the parent vesicle may be found an explanation of the origin of the second variety of hydatid tumor, the multiple echinococcus cysts ; the primary vesicle sets free independent and self-supporting organisms, which repeat the peculiar aggregate of life which gave them birth.

The administration of medicine promises nothing for the removal of echinococcus of the breast, operative interference must be resorted to before a cure is effected. It will rarely be found necessary to amputate the entire breast, nor is it essential to success to remove every particle of the cyst wall ; by opening the cyst and removing the fluid with a trocar, and then irritating the endocyst, sufficient inflammation will be set up to cause the obliteration of the sac. Various methods have been proposed to accomplish the destruction of the parasite. Electricity is favorably spoken of by some operators. H. Flagg thrusts two gilded steel needles into the tumor about two inches apart, and connects both with the positive pole, while he places the negative pole of a constant current between the needles, and allows the current to pass for about twenty-five minutes. Recamier recommended cauterization as a means of opening the cyst. Different irritating fluids have been injected into the cyst, but the practice has not been followed by encouraging results. Mr. Brikett advises the following operation. If the integuments are thin, empty the cyst of its fluid contents with a trocar and canula. On the probe introduce a probe-pointed bistoury, with which an incision should be made of sufficient length to reach the parent vesicle and allow the free vesicles to escape from the opening. If the primary vesicle is not discharged at once, and its attachments are too strong to be broken up without causing unnecessary irritation, a piece of lint may be inserted between the enveloping and the primary cyst, and in a few days the remaining portion will slough away. The parts may then be supported with a bandage ; perhaps early cicatrization of the surfaces of the

cavity would be facilitated by the application of a firm compress under the bandage.

It is difficult to understand the advantage of such an operation over the simple incision, or possibly removal of the sac. The success of any operation is in inverse ratio to the complicated character of the procedure, and when a simple incision, with dissection of the cyst, or irritation with a weak solution of caustic potash or nitrate of silver, will accomplish the cure, I cannot see that the method should be changed for more troublesome and complicated ones.

CHAPTER III.

DISEASES ASSOCIATED WITH THE FUNCTIONAL ACTIVITY OF THE MAMMARY GLAND, AND OF THE GENERATIVE ORGANS.

A. Inflammation.

The tissues of the breast may inflame separately, or the whole breast may become inflamed; generally the process begins in one structure, but spreads rapidly to the other tissues of which the organ is composed. The majority of cases are associated with some action of the reproductive organs, either the effort to establish menstruation, or the established but irregularly performed function; gestation; or lactation, and may be referred either to an increase in the blood supply or alteration in the constituents of the blood, or reflex nervous action, in any case irritation immediately precedes the symptoms of inflammation. Whether these are also always accompanied with the presence of germ life as a cause, may be questioned unless it is intended to assign such a role to the germs already and always present in the organism.

The ætiology of inflammation of the breast, does not differ from that pertaining to inflammation in other organs. The local process whatever may be the cause, begins with enlargement of the capillaries, and consequent infiltration of the constituents of the blood through the walls of the

vessels, hence producing swelling, and "inflammatory exudation." This exudation, which consists for the most part of colorless blood corpuscles escaped through the trabeculæ of the vascular walls, but also of serum and cells derived from the infiltrated tissues, though this is a later complication, remains to be either absorbed, that is taken up by the mammary lymphatics, and thus conveyed again into the blood circulation; or to pass into the state of fatty degeneration, the milk-like detritus of which favors absorption, though it is questionable whether absorption can take place before a fatty degeneration of the cellular elements: or finally from the nature of the infiltrating matter being poorly adapted to absorption, continues to exist as a local abnormality.

Inflammatory exudations according to the course taken for their disposal form the matrix for many diseases of the breast that have for their distinctive feature the addition to or increase of the normal cellular elements of the organ. The exudation not taking the way of resolution becomes organized by the development of blood vessels according to the process which is a repetition of the development of a circulating system in the embryo, into fibrous connective tissues; or if there is an inherited or acquired tendency, as scrofula, to a peculiar cellular form or histogenesis, this tendency is liable to effect the form of unstable cells,—those that have escaped from their normal channel and have thus become wandering, and for this reason, that being unformed they are susceptible to external influences.

Still another result of inflammatory exudation, is suppuration, but this depends upon the continuation of the process that favors the migration of the white blood or lymph corpuscles through the vessels into the surrounding connective tissue. This continued supply of lymph corpuscles cannot probably be maintained, especially in extensive suppuration, unless there is a corresponding activity on the part of the lymph manufacturing organs, the spleen, medulla, and the lymphatic glands, and the swelling of the lymphatics in the vicinity of the seat of inflammation is a constantly observed phenomena.

The pus cell possesses no power as a tissue-forming element, its life cycle is completed and allowed to follow a natural course, in fatty degeneration, and this when occurring in the contents of a circumscribed collection, an abscess, is not readily absorbed but more frequently remains as a nodule composed of dead cells.

a. Inflammation of the Nipple.

Inflammation of the nipple usually occurs during the first month of lactation, especially with primipara, and may be limited to the cutis or attack the subcutaneous tissue. Mr. Birkett believes that the minute follicular glands that are scattered over the nipple are the structures in which the inflammation is centered. The causes of inflammation of the nipple, and as a secondary complication the areola, are to be sought for in the irritation arising from the pressure of the child's mouth upon the delicate cuticle, or the presence of aphthæ in the mouth of the child, which is easily communicated to the mammilla; or possibly the stoppage with milk, of one of the minute ducts that pass into the nipple.

Inflammation arising in the nipple is rarely confined to that structure during its whole course, but soon involves contiguous structures. The disease begins as a dryness and roughness of the skin, with heat, smarting, and a slight degree of redness. Vesicles soon appear on the nipple that are probably the natural vesicles enlarged, and these breaking, gradually develop into a fissure, or crack of the nipple.

a. Fissure of the Nipple, may at first be quite unobserved and in some rare cases give but little suffering. Such instances are difficult of explanation unless upon the ground that no nerves are involved in the fissured organ.

The fissure may begin in any part of the nipple and spread so as to almost separate the organ from the breast. The skin may become entirely destroyed and the breast unfitted for lactation. Aside from the pain suffered by the mother and the frequency with which the trouble is followed by abscesses of the mamma, the affection is not without danger to the child, for the secretions of the fissure are mingled with the lacteal fluid. It may be consid-

ered fortunate, that suckling is usually attended with such keen suffering on the part of the mother, otherwise injury would more frequently be inflicted upon the child.

When the inflammation spreads to the deep connective tissue of the nipple, the result is more serious than even fissure, for the inflammation continuing, pus forms and constitutes an

β. *Abscess of the Nipple.* This is known by the presence of pain, but more positively when there is fluctuation in a circumscribed spot. The abscess, unless relieved, may obliterate one or more of the lacteal ducts, or, if it opens spontaneously into a duct, the pus is mingled in dangerous proportions with the milk. The formation of an abscess is more frequent in the areola than in the nipple, but differs from the latter in being less liable to open spontaneously into a lacteal duct and hence less dangerous to the infant; but while less dangerous to the child, inflammation of the areola is frequently followed by the true inflammation of the entire breast.

γ. *Treatment.* Prophylactic measures may avail much in preventing inflammation of the nipple and its consequences, fissure and abscess. During pregnancy, as soon as the nipple begins to enlarge, the parts should be frequently exposed to the air and bathed with cold water, to which a little brandy or pure French spirits may be added. I have found in some cases, when the skin covering the nipple was exceedingly delicate and sensitive, a solution of Salicylic acid, in the proportion of

℞. Salicylic acid - - - ʒ ii.
Brandy - - - - - ℥ i.

to aid in hardening the integument. The nipple may also be brushed night and morning with a soft tooth brush, this treatment serving the double purpose of rendering the parts hard, and when the nipples are small and retracted, of causing their development. After birth the milk should be gently washed from the nipple with tepid water, and never allowed to dry upon the parts. If there is a high degree of inflammation, the nipple after being washed, may be painted with a five grain solution of nitrate of silver, and if suck-

ling is permitted from the diseased side, care should be taken not to allow the nipple to remain too long in the child's mouth, for the nipple is injured by long continued sucking, and the child's saliva. Between the acts of nursing, it is desirable to keep the nipple from becoming dry, for this is a step towards the fissure, which, though insignificant in appearance, is almost always the initial stage in abscess of the gland. For this purpose I have painted the nipple with flexible collodion excepting at its apex, but can speak more confidently of the results of painting the parts with the compound tincture of benzoin. Benzoin so applied in no way interferes with nursing, while it furnishes a covering that is impervious to saliva or milk and at the same time exercises specific healing powers upon the raw surface. Nipple shields are of more service before the fissure or ulcer has formed, when the parts are very sensitive to the child's mouth. In extremely rare cases it will be necessary to use a shield in conjunction with the benzoin varnish.

For sensitive and also fissure nipples, at almost any period of lactation, much relief is obtained, and sometimes a cure, by keeping the parts wet with a solution of Goulard's extract ; a teaspoonful to a tumbler of water, at the same time observing the strictest cleanliness.

There is no better means of arresting inflammation, than the application of hot water, but this must be begun early in the course of the disease, else little good will follow. The water should be applied on flannel cloth, and over this a piece of oiled silk or thin rubber. The cloth should be changed at first, every fifteen minutes, but later every half hour, or hour. If the surgeon can personally superintend this treatment, or has secured the assistance of a competent nurse it is well to follow the application of hot water, by that of cold water, but in this the greatest care is necessary, for while the hot application opens the canals of the connective tissues, the lymph spaces, thus facilitating the removal of the exudations, cold water, while it contracts the blood vessels preventing further emigration of colorless blood corpuscles, acts in like man-

ner on the absorbents, and the inflammatory exudation remains in the same position as before. My custom has been, if the case is of recent origin, that is, when the pathology is represented by relaxation of the blood vessels and enlargement of the lymphatic trabeculæ, but before any considerable exudation has taken place to begin with the application of cold, even ice water. This treatment will usually in a few hours be followed by complete relief of the congestion. If the case is of longer standing and exudation has actually taken place, hot water will be essential to a cure. I make the cold application for from one to twenty-four hours, according to the intensity of the inflammation, judging of the time to begin the hot application by a decrease of swelling and the attendant pain. The hot cloths as thus applied, with frequent renewal, until the swelling has subsided and the part assumed a natural appearance. This method of treatment is based upon the principle that the cold application stops further exudation and wandering of white blood corpuscles, and that if this contraction of the openings of the vessels and undue multiplication of colorless corpuscles is arrested, the parts and functions will be restored to their natural state and operation, and that the hot applications after the wandering corpuscles have passed into the cellular tissues, removes these by stimulating the lymphatics to activity. This treatment it, will be remembered is advised only for comparatively recent cases.

The medicine that will usually be found of service in the first stages of inflammation and fissure are : *arnica*, *castor equorum*, *chamomilla*, *graphite*, *ignatia*, *pulsatilla*, *sepia*, *silicia*, *zincum met.* If this inflammation proceeds to cracking of the nipple the fissure is quickly healed when not deep by observing strict cleanliness and preventing contact of the milk with the raw surface, to this end the parts may be frequently bathed with tepid water and a piece of soft linen laid over the fissure or between its lips. Calendula, calendulated oil, or cerate, may be used to dress the fissure. A dressing composed of equal parts of castor oil and glycerine is very soothing, perhaps more so,

than actually healing. If there is no discharge from the fissure the tincture of benzoin, as recommended to prevent cracking, will yield excellent results ; if there is a discharge from the raw surface, absorbent cotton with a simple ointment, or without any ointment, will be all that is necessary to effect healing.

Should an abscess form in either the nipple or areola, too much delay is not advisable before evacuating the pus. Resolution is rarely accomplished and the purulent matter may cause harm by burrowing in the intercellular tissue of the nipple. The incision should be made in the course of the lactiferous ducts, that is, from within outward.

It is well to keep the edge of the wound separated until all discharge has ceased ; to this end a small pledget of lint, or better, wool, may be inserted between the wounded surfaces, as in the treatment of other abscesses.

Hepar, *phytolacca*, *silicia*, and *sulphur* are among the most frequently called for remedies.

To facilitate maturing of the abscess a large poultice of bread and water or of flax-seed may be applied, but unless suppuration takes place in deep structures, or beneath unyielding tissues, it is questionable practice. The action of a poultice upon suppuration is twofold, it not only causes the inflammatory exudation to become localized by dilating the interstices of the connective tissue, but it also, unless medicated, acts directly on the proliferating capacity of cells, and causes them to accumulate in greater numbers. Poultices are most useful, but it can not be questioned that when improperly used, or used for too long a time, they may increase the trouble they are employed against. The action upon formed tissues, the integument, of moisture and heat, the principal constituents of all poultices, is to reduce vitality. The blood is driven from the vessels and the tissues are less able to return to the healthy performance of their functions than before the poultice was applied. Hence in using a poultice the time more than the method of its application is to be considered. When the abscess is ripe remove the poultice, even though the pus is situated deeply ; if the application is continued beyond that period

with the design of softening the superimposed tissues, this result will probably not be accomplished, and if the structures should thus be rendered thinner and softer, this has been at the expense of a loss of vitality, which will have the effect of preventing the timely healing of the incision. An abscess of the nipple, is more speedily cured when not allowed to break, but is opened with a knife; thus also avoiding a probable unsightly gathering together of the tissues about the seat of the abscess.

A simple water dressing or one of calendula may be used, but the moist dressing for wounds is followed by less satisfactory results than the dry dressings. For these simple cases a little pure palm oil spread on a piece of lint and this laid on the wound. It may be removed as frequently as the nature or quantity of the discharge demands. A few drops of eucalyptus oil may be added to the palm oil, if there is reason for employing antiseptic precautions; or still better, sublimated glycerine or sublimated olive oil, 1.1000, applied in the same manner, over which a covering of dry absorbent cotton may be placed. Sublimated cotton also makes a most reliable and satisfactory dressing.

b. Inflammation of the Gland.

α. Subcutaneous Inflammation.—The anterior layer of fascia in which this variety of inflammation occurs is loose and favorably constructed for inflammatory exudation, and because of its structure inflammation is less serious than when attacking the same tissue differently situated.

Dilatation of the blood vessels is here permitted to a considerable degree without giving rise to obstruction of the current of blood, and the following infiltration. The inflammation, however, is generally followed by suppuration, usually circumscribed and situated at the most dependent portion of the gland. This will obviously change with the most constant position of the patient.

Though the subcutaneous suppuration is generally centered in a single abscess, occasionally the abscesses are multiple, and M. Velpeau has observed that the single

abscess is unconnected with lactation or pregnancy, or with diseases of the gland, but depends upon physical or mechanical causes, or upon a general constitutional tendency, and that multiple subcutaneous abscesses of the breast are connected with lactation. So careful an observer as M. Velpeau cannot be credited with making a mistake in such a generalization as the foregoing, but I have frequently met with multiple subcutaneous abscesses unconnected with the lacteal functions, and there seems to be no reason why, excepting to gravitate to the most dependent part, that pus should not form in as many places as there are infiltrations of inflammatory lymph, and these points may be multiple in the loose connective tissue covering of the breast.

The symptoms of subcutaneous inflammation are those that usually mark the inflammatory process, heat, swelling, and redness ; but even though lactation is in progress it is not generally interfered with. The gland is not raised from the chest more than in the natural state, but the swelling is upon the gland. The nipple is quite normal when the inflammation remains confined to the subcutaneous tissue, but if there is a high degree of inflammation and swelling, or the nipple is implicated, the latter becomes somewhat depressed, or apparently so, because of the surrounding tumefaction.

The pus shows a tendency to make its way towards the gland quite as frequently as towards the skin, rendering necessary an early use of the knife. The reason for this is probably mechanical, for the pus finds less resistance in the direction of the interlobular tissue on the surface of the gland, and next to the subcutaneous tissue, mostly composed of fat, than in the direction of the integument ; it is in the interlobular glandular tissue that the secondary and multiple abscesses of subcutaneous inflammation are situated.

The causes of subcutaneous mammary inflammation are not always easy to discover. When idiopathic the inflammation is usually to be traced to some irritation or injury to the skin covering the breast, but in many cases there is no such history and we are therefore obliged to accept the

condition without ascertaining the cause. The influence of the lacteal or ovarian functions in causing primary subcutaneous inflammation is probably very inconsiderable, but as a secondary affection subcutaneous inflammation may almost always be referred to trouble in the mammary gland, and this in turn to lactation or reproductive disorders.

β. *Submammary Inflammation.*—The posterior layer of connective tissue which separates the mammary gland from the pectoral muscles, may be the seat of inflammation. It is probable that this tissue contains, if it does not secrete, a small quantity of serous fluid, the office of which is to facilitate the motion of the gland upon the chest during the respiratory act. M. Nélaton describes this as a cellular bursa, but I have been unable, from careful dissections, to discover any limiting membrane that could be properly called a bursa; when there is increased fluid in the deep fascia it is not circumscribed, but diffused throughout the connective tissue, having its boundary at a point where the gland ceases to rest upon the underlying muscles.

From the deep situation of the submammary tissue and the physiological office that it performs, it is evident that inflammation of this tissue will be followed by certain well-marked objective and subjective symptoms. The first symptoms are a sense of uneasiness deep in the breast with no corresponding change in the appearance of the organ. As this increases the whole organ is pushed forward and the nipple becomes more prominent. If the cutaneous covering of the breast shows signs of inflammation, which is not a constant condition, the redness first shows itself in a turgescence of the cutaneous veins, and later, phlegmon proceeds from the base of the gland toward the nipple.

Pain and soreness are increased by anything that moves the breast upon the pectoral muscles, hence motion of the shoulder of the corresponding side and deep respiration aggravate the suffering; also the weight of the breast, if allowed to hang unsupported, is the cause of intense pain.

The constitutional symptoms are generally severe, and

suppuration takes place early, resulting in a copious formation of pus. There is high fever, and considerable swelling of the breast, which when touched, if the disease is far advanced, feels as if supported on a bag filled with fluid, but unless the collection of pus is large there is no bulging around the base of the gland. The formation of pus, as in other deeply-situated tissues, is indicated by severe chills and throbbing pains. From the unyielding nature of the tissues in front of the abscess, the pus, by burrowing, may give rise to most serious complications. It has been known to work its way between the lobes of the gland, giving rise to secondary abscesses in that situation ; downwards, upon the pectoral muscles, or in the direction of the neck or axilla, following the course of the lymphatics, or even through the walls of the chest, causing disorganization of the costal cartilages, and intercostal muscles ; and finally to enter into the cavity of the pleura. Such instances are fortunately rare.

Though the inflammation is usually circumscribed, rarely extending beyond the boundary of the sac formed by the union of the deep and superficial tissues, occasionally cases are met with in which the process is much more extensive, involving the superficial coverings of the chest, but the formation of pus is confined to the mammary region. The causes of submammary inflammation are, in many instances, inflammation of the gland structure, which rapidly spreads to the submammary fascia, processes of which pass into the gland and divide it into lobes ; arrest of lactation, and the subsequent closure of lacteal ducts ; or diseases of the chest, pleurisy, or injuries of the ribs ; but I believe this inflammation arises more frequently from the process of mammary involution than from any other cause. This folding up of the gland occurs, to a limited degree, at each menstruation, and if the process is imperfect the gland cells are either arrested in the lymphatics, as these vessels pass through the submammary fascia, or escaping from their natural channels pass into the fascia and give rise to inflammation. Such a local irritation might remain for a length of time without giving rise to any serious trouble, until aroused into activity

by the awakening of some constitutional taint: an injury, or an oft-repeated incomplete involution.

The progress of submammary inflammation is very rapid. Large abscesses form in three or four days, but the pointing of the abscess is slow. When it opens externally, it is usually at several places around the periphery of the gland; if the pus burrows between the lobules of the gland it may discharge itself near the areola, because at that point the gland tissue offers the least resistance. Resolution is usually delayed, the severity of the symptoms having caused too extensive destruction of tissue to insure rapid recovery.

γ. *Parenchymatous Inflammation, Mazoitis.*—The parenchyma of the breast is made up of ducts and lobules, lined with epithelial cells; of basement membrane upon which these are supported, and of interacinous tissue. Each one of these may become inflamed separately, though generally inflammation beginning at one tissue spreads rapidly to the other tissues of the breast; and although pathologically there are to be observed distinctions between the varieties of inflammation of the parenchyma, clinically, it is frequently extremely difficult to do so, unless in the first stages of the disease.

It is in parenchymatous inflammation, and especially that variety that is more especially concerned with the hyper-nutrition of epithelial cells, that the permanent or chronic inflammatory products have their origin; it is in inflammation of this tissue, more frequently than in the other tissues of the breast, that pathological new formations of the mammæ receive their impetus to grow.

Mazoitis is so generally associated with lactation, or the evolution or involution of the gland, more especially the latter or with functional activity of the reproductive organs, that its pathology and history, almost of necessity, include a study of these primary processes and disorders. If inflammation arises from lactation the first stage is probably one of stasis of the vessels that supply the particular duct or lobule affected. This stasis may be caused either by pressure from within the duct, the result of accumulation

of lactal cells that cannot be discharged, or the same cause, acting as a local irritant, supplies a stimulus to the too rapid multiplication and accumulation of white blood corpuscles within the tissue. If inflammation occurs unconnected with lactation, it may be found at the period of menstruation, at which time, the breasts repeat in a limited degree, the two sets of phenomena that constitute lactation. The inflammation attendant upon menstruation may be accumulative, for it is probable that the mammary involution that follows a single menstruation would only in exceptional instances be sufficient to set up more than a slight congestion, possibly at first rather the conditions favorable to congestion. But this same process being frequently repeated, will in time induce such changes as to bring about true inflammation.

The first symptoms of mazoitis that is caused by irregular menstruation, are usually so slight as to attract little attention. Sensitiveness of the breasts, with possibly a little pain, all of which pass away to return at the next menstruation, probably with increased violence. This condition may continue for years, but I am inclined to believe that if not arrested, it will lead to more serious trouble, and I am further disposed to look upon a very considerable number of the pathological formations found in the breast in later years, as having their origin in the inflammation that arises from oft repeated imperfect involution of the gland. Two results of this oft repeated activity, which may exist together or singly, contribute to make this true: either the irritation may cause such a dilatation of the blood vessels as to induce hypernutrition, or this being held in abeyance, the imperfectly involuted lacteal cells pass into the state of infiltrating cells and form a histological focus for the development of heterogeneous cell types. This subject has been discussed more fully, when speaking of the ætiology of neoplasms of the mammæ.

The symptoms of mazoitis are usually well marked. Connected with or following lactation, or beginning at a menstrual period, are reasons for considering a swelling and inflammation of the breast as parenchymatous;

and if this swelling is at first hard and lobulated, soon involving the entire organ, with excessive soreness and throbbing, sharp, shooting pain running into the axilla, frequently with swelling of the axillary lymphatics, there can scarcely remain any doubt concerning the diagnosis as the inflammation progresses, and if suppuration, which usually results, is established, the constitutional symptoms become more severe.

Parenchymatous abscesses arise deeply in the lacteal tubes, or the interacinous tissue, and are either very large or numerous. M. Velpeau has observed fifty-two in one breast, but this number is unusual. The progress of suppuration is slower than in any other mammary inflammation; sometimes three or four weeks are consumed before the abscess reaches maturity. The case is also much delayed, for as one abscess heals, another forms. The reason for this successive formation of abscesses is not clear. It occurs in no other form of inflammation of the breast and is so frequent in mazoitis as to render it alone a diagnostic sign of some value. If inflammation of the tissues continues to spread, it is natural that suppuration should continue with it; but frequently, after all apparent inflammation has gone, and little soreness remains save that connected with the healing abscess, these collections of pus will continue to form. It is possible that the infiltration that precedes suppuration, occurs for each abscess while the inflammation is at its maximum, and that from the nature of the tissue in which the process takes place, the further multiplication of cells is in some locations delayed.

The anatomical arrangement of the breast permits the burrowing of pus wherever formed. It is by burrowing, that the shirt-stud or dumb-bell abscesses are formed. A collection of pus forms in the glandular tissue, and another abscess which may arise separately forms in the submammary tissue. The tissue between these two collections breaks down, and the abscesses are united by a canal, having a secreting surface.

Parenchymatous abscesses not infrequently, if allowed to open spontaneously, leave fistulous openings in the gland

which prove very intractable to treatment, for the abscesses being deeply situated, and the openings running into and across lacteal ducts, these openings are converted into lacteal fistulæ, which are rendered difficult to heal, because milk flows through them, mixed with the secretion from the abscess. In some instances there is extensive sloughing of the tissues that cover the abscess, and the bottom of the cavity becomes exposed to view. Sometimes several collections of pus are found to open into each other.

The results of mazoitis make it the most serious form of inflammation that attacks the breast. Not only does the child suffer, if the disease accompanies lactation, but the organic changes that take place in the gland when suppuration supervenes are highly favorable to the permanent degeneration of cell type and the genesis of conditions advantageous to the localization of a constitutional disease.

δ. *Lymphatic Inflammation.*—M. Velpeau was the first to describe inflammation of the mammary lymphatics as a distinct disease; but in view of the present more perfect knowledge of the pathology of lymph-vessels, it may be questioned whether such a description can be maintained. The lymphatic channels, both afferent and efferent, perform the office of conveying certain cellular elements to and from the lymphatic glands; the latter cannot become inflamed unless from poisonous matter carried into them, or from arrest of the cells that should pass through the gland within the trabeculae, or some part of the secreting organ.

Lymphangitis is always the result of irritation from a poison passing through the lymphatic vessels (Billroth), and although this is said of traumatic lymphangitis, it is equally true of the disease occurring under any circumstances. The inflammation is always a secondary affection dependent upon some more deeply seated trouble, connected with the functional activity of the breast.

As there are two sets of lymphatics, the superficial and the deep, so there are two varieties of lymphangitis of the breast, corresponding to the anatomical arrangement of the vessels involved. The superficial inflammation is easily recognized. There are red patches and streaks leading in

rays from the breast to the arm-pit, that generally start from the region of the nipple. On the red striæ are painful spots which form foci of the disease and represent small glands through which the vessels pass. This form of lymphangitis usually has its origin in some irritation of the nipple connected with lactation, as fissured nipple, abscess of the papillæ of the areola, or some kindred affections.

Lymphangitis of the deep vessels, which, in an early stage, may be unconnected with the superficial inflammation, is of a more serious character, and more difficult to diagnose. There are no red striæ, but the lymphatic vessels are recognized by cord-like bodies that spread from the centre to the circumference of the breast, more especially in the direction of the axilla. These are sensitive to touch, especially the small glandular bodies in the course of the lymph channels. The axillary glands always suffer enlargement at a later stage: they are very painful, as are also the lymphatics leading from the breast to the axilla. If the deep lymphatic inflammation is uncomplicated with superficial troubles, there is not much general redness of the breast, nor is it usual to find any considerable swelling, save of deep lymphatic cords, which are recognized by the touch, rather than the eye.

One of the most characteristic symptoms of lymphangitis, superficial or deep, is the change in color that the redness passes through. At first bright red, this soon gives place to a dull coppery hue, much resembling the redness of erysipelas. Indeed, between lymphangitis and erysipelas there is much in common, and while it cannot be said that they are identical, the resemblance suggests that both affections arise from the absorption of poisonous material into the lymph trunks.

Mammary lymphangitis is very rarely an idiopathic disease, but almost always depends upon some injury or other local irritation, and there is ground for believing that almost any disease of the lacteal gland, giving rise to poisonous material, may set up inflammation of the lymphatics. When idiopathic, the cause probably resides in the gland structures, and is of such a nature that even natural fluids

cannot pass through the lymphatic filter and so give rise to irritation.

Lymphatic inflammation, more than inflammation of any other structure of the breast, may, with reasonable assurance, be expected to terminate in resolution ; and even when pus forms, the abscess is amenable to treatment. If the suppuration is superficial the pointing is not delayed, and the cavity heals rapidly; but if the suppuration is deep, the process of maturing and recovery is more tedious.

A variety of inflammation of the breast called "weed" is occasionally met with about the tenth day of lactation. It is not dependent upon either chapped or irritable nipples, nor does it proceed to caking of the breast or suppuration. The symptoms are headache and high temperature, the breast is very tender, swollen and painful, of purple color, but neither tense nor glistening. The condition begins to abate in about twenty-four hours, and in a few days the gland assumes its natural function and appearance. This inflammation is probably associated with the beginning of the functional activity of the mammary lymphatics.

ε. *Acute Mammary Abscess* requires no more description than the mention it has received in connection with the various forms of inflammation.

Chronic or Cold Abscess. The conditions that give rise to this collection of pus differ from the inflammatory phenomena that precede the formation of an acute abscess. There is very little of what we have regarded as inflammation. Vascular excitement is not a prominent symptom, and there is not observed that "distention and multiplication of the capillary vessels by the formation of loops" that forms an essential feature of acute inflammation. This, however, is not entirely absent; for the tendency to the new formation of tissue, and serious infiltration shown in chronic inflammation to a greater extent even than in acute inflammation, requires an additional supply of blood, and such a degree of change in the vascular walls as to permit wandering of the white blood corpuscles.

It is not probable that all pus originates in the white blood corpuscles after they have become elements of infiltration, but that a formative irritation of stable connective tissue corpuscles may give rise to collections of pus ; I am inclined to believe that this irritation forms a constant feature of chronic inflammation. The irritation is not of necessity vascular, but rather nutritive, there being an area of cell growth that falls below the maintaining power, essential to health. Under their influence the stable cells and the peculiar cells of the affected part cease to develop into the type that fits them to form a permanent histological element, for inflammation is not an increase, but an arrest of healthy action.

Time enters as a most important factor in the development of the cold abscesses. The entire process is slow, after the wandering cells have collected, or the stable cells begun to proliferate.

As before said, there seems reason for believing that the latter most frequently constitutes the initial point for the development of cold abscesses; this being the case, the irritation of the surrounding tissue is slow, and hence the chronic character of the suppuration. It is also probable that the slow formation of the pyogenic membrane—a structure that depends upon the migration of fibrin-forming elements, primary lymph cells and invisible corpuscles from the circulation—a slowness consequent upon the slightly increased activity of the blood-forming organs, as well as the small numbers of leucocytes and lymph corpuscles that pass into a condition of infiltration—contributes to make the cold abscess an almost entirely local cell derangement.

There is a form of abscess, not peculiar to the breast, but found in almost any tissue of the body, that is sometimes confounded with the chronic abscess, but which is quite distinct from the result of chronic inflammation, and may with much more propriety be called the secondary abscess. It is, I believe, always the result of a strumous diathesis, as is also chronic inflammation, and is developed in an induration composed of inflammatory lymph cells that has

existed for some time. These collections of lymph cells, for some unknown reason, remain in a state of simple infiltration, without the rapid proliferation that attends the formation of pus ; or when pus has formed in them the proliferation stops, and these cells take on their natural changes and pass into fatty degeneration.

These secondary abscesses therefore follow, but at a distance, a more or less severe inflammation ; and the principal clinical difference between them and the chronic abscess is that the latter is accompanied with some degree of inflammation, while the former follows inflammation. Secondary abscesses are really the spontaneous disruction of a scrofulous tumor, and may become acute from the time of the development of the inflammatory phenomena that cause the infiltrated lymph to break up into pus.

It is probable that secondary abscesses are, in some instances, remotely the sequelæ of chronic inflammation ; for it is conceivable that the infiltration from chronic inflammation may not proceed to the formation of pus, and that a fresh inflammation, attacking the focus of infiltration, adds to that infiltration active leucocytes and lymph corpuscles, which, mingling with those already formed, convert the inactive mass into an acute abscess. The first symptom observed of a chronic abscess is usually a hard lump in the breast, situated deeply, frequently unaccompanied with either pain or sensitiveness ; when these are present they are slight compared with the size of the swelling. The pulse remains about normal and there is no change in the color of the integument covering the breast. The swelling continues to increase in size, but with no acceleration of any symptoms to indicate inflammatory action.

Chronic abscesses occur most frequently in early life, agreeable to a strumous origin of the disorder, and frequently during lactation. Whether obstruction of a lacteal duct can be considered as an exciting cause, cannot be determined, but generally it may be said that any long acting function, physiological or pathological, that is not rapid, induces chronic troubles, and if lactation continues beyond what may be considered as a reasonable period this

long-continued physiological action may induce the chronic inflammation that precedes a cold abscess.

A chronic abscess of the breast may remain stationary for years, or gradually increasing in size, there is without apparent cause a sudden change in the swelling, the breast becomes painful, active suppuration begins, and a spontaneous opening of the abscess occurs near the nipple. After the opening of the abscess the bottom of the cavity sometimes assumes a fungous appearance, from the excessive development of granulation tissue. Other abscesses, or extensions of the primary collection of pus, open, and the general health may become seriously involved.

The healing of a chronic abscess is somewhat delayed, for the surrounding tissue suffers from the long continued morbid condition that precedes the formation of pus ; lacteal fistulæ frequently follow the slow healing of a chronic mammary abscess.

There is occasionally met a rare form of chronic abscess not distinguishable clinically from the scrofulous tumor, excepting in the quality of the discharge after the swelling is opened. The tumor has its origin in chronic inflammation, but from the slowness of the process and the cessation of the formation of pus the latter sets up sufficient local irritation to form a dense connective tissue wall about the inflammatory collection, in the same manner in which the cestoidal wall is formed. This wall becomes vitilized by the development of blood vessels within its substance and thus isolates the contents of the cyst. The endogenous multiplication of cells—not of necessity pus cells—within the wall is the means of self destruction, for the power of distention of the connective tissue envelope is limited. The discharge from the spontaneously opened tumor will contain very little pus, for the contents of the tumor have ceased to be purulent and consist of broken-down tissue and fat cells.

The diagnosis of a chronic abscess is sometimes a matter of considerable difficulty. The tumor that precedes the more active symptoms of inflammation may be mistaken for a fibroid tumor, or even scirrhous, and frequently the

supervention of suppuration and subsequent opening of the abscess present many symptoms that simulate medullary carcinoma.

The history and constitutional symptoms which must exclude a cachexy, and the profound vital depression characteristic of malignancy, will generally lead to a correct estimate of the nature of the disease.

η. *Treatment of Inflammation and Abscess of the Breast.*—The normal congestion of the breast attendant upon the establishment of lactation, that which passes into the unfolding of the gland, is usually transient, and will cease when an equilibrium has been established between the supply of blood and the multiplication of milk cells, and will require no other treatment than such hygienic precautions as reason dictates; but if the congestion proceeds to inflammation, and if to this is added an irritable and fissured nipple, prompt treatment is called for. The nature of this treatment will depend upon the exciting cause of and the particular tissue involved in the inflammation. If distention of the lacteal tubes with milk gives rise to the inflammation, that is, if the trouble originates within the gland substance from mechanical obstruction to the flow of milk, the child should early be given the breast. When this is not possible, either because of the death of the child or deformity or disease of the nipple, mechanical means for removing the milk are to be substituted for the natural means of emptying the breast. Many breast pumps have been devised, but with few exceptions they injure the sensitive gland structure, and do not permit the touch which is necessary to direct the degree of suction or pressure to be made; moreover, they are faulty in principle, for they draw upon a flaccid tube, the walls of which are in contact, to remove something at the end of that tube, and the very act of drawing approximates the walls of the duct and hence prevents the gland from being emptied.

The method is the same as that of natural nursing, but it must be remembered that in the one case we have to deal with perfectly healthy conditions, in which the caliber of the lacteal duct is large enough to permit the fluid milk to

pass through it, while in the other case the duct is obstructed and swollen, and the milk has lost some of its watery constituents, and hence a greater degree of suction is required to empty the distended lobule. Pressure acting directly upon the surcharged portion of the gland is in general sufficient to overcome this obstruction and the cause of irritation. This pressure should be applied with gentleness towards the nipple, and especially over the spot where the hardness, if any, exists, and is circumscribed. The hand, or better both hands, acting upon opposite sides of the gland, should be well oiled to avoid the possibility of even superficial injury. For this purpose I find nothing better than an ointment composed of

$$\text{℞. }\left.\begin{array}{l}\text{Sperm oil,}\\ \text{Sweet oil,}\\ \text{White wax.}\end{array}\right\}\text{ ā. ā. ℥ iii.}$$

I have occasionally succeeded in removing cakes from the breast, with the conjoined use of the hands—pressure—and a simple suction apparatus, consisting of a strong bottle with a sufficiently large mouth to receive the nipple, but no portion of the areola. The bottle is placed in boiling water; when the air which it contains has become sufficiently expanded—to accomplish this only a few minutes will be required—the nozzle of the bottle is fitted to the nipple. The cooling glass causes contraction of the air within the bottle and thus suction is produced. To prevent undue heat of that portion of the bottle that comes in contact with the breast the water in which the bottle is placed for heating should not cover its neck. Sometimes so much pain is caused by this method, that the suction can be continued only a few minutes at a time, but in removing the bottle, the nipple must be protected from injury. To accomplish this the breast may be depressed at the side to admit air to the bottle, or warmth may be applied to the bottle. If the breast is very sensitive it may be protected from the contact of clothing by placing over it a cradle of wire, or pieces of hoops so arranged as to rest on the bed, and remove all pressure from the thorax.

The use of cold, as a means of reducing inflammation, is gaining favor among surgeons, for it is ascertained that the temperature of the body when above normal, as in peritonitis, can be reduced without causing a chill, the pathological significance of which is congestion to an internal organ. It requires no demonstration to show that the best results from the application of cold are obtained when the congestion is circumscribed, and hence it has proved valuable as a prophylactic against mammary abscess, but I believe its usefulness is limited to the early stages of congestion, before there is any suspicion that pus has formed. After suppuration, I have found cold applications useless if not harmful. The cold should be applied at the beginning of soreness, redness and pain, either with cloths wrung out in ice water, or a rubber bag containing cracked ice, or a coil of rubber tubing, adapted to the shape of the breast. If used at this stage, the relief from pain is almost immediate, and the swelling and other symptoms of incipient suppuration are generally removed within twenty-four hours. When the pain has ceased, together with the active symptoms of congestion, the cold must be discontinued or there will be a reaction from the anæmic condition it induces, and this will be more difficult to control than the primary congestion.

Though seemingly paradoxical, heat will accomplish much the same results in aborting inflammation that are known to follow the use of cold. The latter probably acts by arresting the multiplication of white blood corpuscles, the inflammatory elements, and preventing their infiltration and migration ; the former possesses the power of stimulating muscular contraction and restoring the circulation when this has become disturbed by accumulation of the elements of the blood. This has been referred to elsewhere.

If the attempt to accomplish resolution fails, and suppuration takes place, and this will almost always be consecutive upon a severe chill not followed by a corresponding rise in temperature, it is advisable to open the abscess and *hepar. sulph.* or *staphysagria* may be given to hasten the pointing process. A poultice may be made of service when

the pus is deeply situated, but unless urgently called for, should be avoided for the reason already mentioned.

The effort to bring about the absorption of pus can not be viewed with favor, either from a pathological or clinical standpoint. For *first*, if pus is absorbed, and this has no other meaning than that the pus corpuscles enter into the lymphatic or blood circulation, a pathological element is carried to distant parts,—an element capable under favorable conditions of exciting in the cell territory in which it lodges the same process of cell proliferation of which it was a part; and *second*, if the pus as such is not absorbed, —and this is the most frequent disposition of purulent matter when there is no considerable reduction of vital resistance as that which precedes pyæmia—the pus cells undergo fatty degeneration, which constitutes one step in the morphology of cells that ultimately form pathological new formations. Moreover, before fatty metamorphosis takes place, and consequent infiltration, the fluid elements of pus are absorbed, and the more solid constituents remain in the breast, where they are liable to form a nucleus upon which some more serious disorder may be grafted. In opening a mammary abscess, especially if the pus lies deeply, there is danger of cutting a lacteal duct, with the liability of a lacteal fistula following. This risk is diminished by cutting through the skin only, and then on a director, in the direction of the milk ducts, towards the nipple. Or if the abscess is submammary, after the superficial incision is made, a director may be pushed up towards the pus until it enters the abscess cavity. Upon the director is then passed a pair of closed dressing forceps, which, when they have gained the abscess cavity, are allowed to expand; this will cause a sufficient enlargement to allow a free flow of pus, and the opening so made being a torn wound, will not close before the abscess has healed from the bottom. If, however, it is thought necessary, a drainage tube may be introduced.

Mr. J. F. Le Page of Manchester, England, has devised a very useful single instrument for opening deep abscesses. It consists of two blades, one of which is longer than the

other and provided with a conical point, and is intended to be thrust into the abscess cavity. The shorter blade follows closely the longer one, and when both are in the abscess, they are separated to the desired width by means of a screw, and while so held apart, withdrawn, lacerating the tissues as they pass. These methods of opening mammary abscesses, either with the director and bistoury, or with Mr. Le Page's instrument, can not be too highly recommended.

Some surgeons have proposed to evacuate the pus with a trocar and canula, but this method is open to the objection that it may be necessary to retain the canula in the wound until it is healed, and this may mean several months. Recently formed abscesses in which the pus is generally entirely fluid may be expeditiously and safely opened with the large needle of an aspirator. Pus does not usually reaccumulate, if pressure is maintained over the abscess cavity.

A method of operating on abscesses in the neck, recently proposed by Mr. F. J. B. Quinlan, suggests itself as a possible method, whereby the injury of a lacteal duct may be avoided. The manœuvre consists in passing a large curved needle mounted in a handle, and armed with silver wire, deeply into the abscess, and out at the opposite side. The needle is then withdrawn, and the ends of the wire twisted together; the wire is turned at each dressing.

While these conservative methods may be the appropriate treatment in many cases, there will occasionally be found abscesses of the mammæ that require a deep and clean incision. Such are cases that form rapidly and pass through their several stages to suppuration, unaffected by any treatment. They are known by a chill a few hours after the first symptoms of inflammation appear, and if in thirty-six hours the symptoms remain unchanged, pus has formed, and the case calls for prompt treatment and early evacuation. Pus will usually be found at the most dependent part of the breast, and the incision for its evacuation should be bold and free, the object being to give free exit to the purulent collection.

The opinions of surgeons differ concerning the direction that should be given to the incision. M. Velpeau recommended a perpendicular incision, believing that such a cut closes less rapidly than a longitudinal opening. Mr. Ferguson advocates the longitudinal incision, for the reason that thereby the milk ducts are less liable to be injured. It is probable that less injury follows the perpendicular incision than at first appears, for with the swelling of the breast the milk ducts are diverted from their natural course, and an incision in one direction is about as liable to penetrate a lacteal duct as an incision in another direction.

If sinuses are found running out from the abscess cavity, though these usually belong to older abscesses, each one must be laid open by first passing a director through its whole length, and cutting with a bistoury from within outwards. The hæmorrhage that sometimes follows these deep incisions is considerable, but is usually controlled with cold and pressure. It is well to keep the abscess open for a few days by the insertion of a little cotton wool, and to place over this a dry dressing, or a piece of lint or cotton with a little iodoform * or boracic acid. Simple cerate also makes a very useful dressing. Rest in a recumbent position is usually advisable for a few days after the opening of a mammary abscess, and the parts should be supported either in a muslin sling or by strips of adhesive plaster until all sign of irritation has disappeared.

In the early stages of mammary inflammation, or even at the beginning of the blood stagnation that is to result in suppuration, the process may sometimes be arrested, and therefore the necessity of opening an abscess avoided, by strapping the breast with adhesive plaster and applying pressure.

In the opening of abscesses, as well when situated in the mammary gland as elsewhere, the strictest cleanliness

* My method of preparing cotton for this and other dressings is to spray with the steam or hand atomizer a saturated solution of ether and iodoform on absorbent cotton. The ether, evaporating, leaves a fine uniform deposit of iodoform on the cotton, which is removed with the dressing. In the preparation care should be taken, if the steam atomizer is used, to prevent contact of the ether with the spirit-lamp.

should be observed. This is best accomplished by using antiseptic precautions. Before operating it is well to bathe the breast with a 1.1000 solution of the bichloride of mercury. The instruments to be used should also be washed with the same antiseptic 1.500. Unless the pus from the abscess shows signs of degeneration it is not necessary to inject the abscess cavity, but if the discharge is ill-conditioned the sac should be syringed with the bichloride solution. If there is much discharge, and if this continues a long time, I have obtained excellent results from a simple dressing of marine lint. An excellent article is prepared by Westhorp. The lint is a perfect antiseptic and absorbent, and can be changed as frequently as desired. The slight discoloration of the skin that is caused by the tar contained in the lint may be prevented by placing a piece of thin fine linen between the breast and the lint. This piece of linen may be wet with the bichloride solution. A large pad of sublimated cotton also makes an excellent dressing. It is important to the speedy healing of an abscess to make pressure over the cavity. This may be done by means of adhesive straps ; the Mead's adhesive plaster answers this purpose well, or pass a broad bandage about the thorax. The latter method possesses the disadvantage that it necessitates a degree of quiet that the case does not usually require.

Silicia, *phytolacca*, *calcarea hypo.*, will be found of great service in aiding the healing process.

B. Lactiferous fistula consists in an abnormal communication between the skin and a lacteal tube, or any portion of the secreting surface. The walls of this canal become hard and indurated and present much the appearance of the walls of a chronic abscess. They are composed of a dense connective tissue, upon which there is a thick layer of granulation cells, from which and infiltrated lymph cells the pus discharged from the external opening is derived.

The character of the discharge varies with the period of glandular activity at which it occurs. If the discharge takes place during lactation it consists principally of milk,

with which is mingled a small proportion of pus cells ; at other times the discharge is thin and watery, or consists of degenerated pus cells.

Lactiferous fistulæ originate in suppuration of the mammæ, or in some injury done to the gland, but the former is the most frequent cause, especially if the pus is not given free exit ; for the pus by burrowing forms long sinuses in the breast, between the lobules, and these, opening externally at a point quite remote from the starting point, form a suppurating canal difficult to heal and distressing to the patient. Another cause may sometimes be found in the improper opening of an abscess, for if in so doing a milk duct of considerable size is cut the duct may remain open after the abscess has ceased to discharge. Accidental wounds, as from stays, may also give rise to fistulæ of the breast, but the initial step is probably always an abscess.

a. Treatment.—Lactiferous fistulæ sometimes prove very intractable to treatment, especially when associated with lactation. So true is this that it is not advisable to employ more than the simplest methods of cure for fistulæ that occur at that time. If such treatment does not affect a cure, nothing can be done until the upfolding of the gland is completed.

It is not difficult to understand the reason for this ; for the natural determination of blood to the gland, a quantity that during the resting period would be quite abnormal, favors the infiltration of lymph corpuscles and leucocytes, which, by supplying the materials for pus, make the healing of the fistula walls impossible ; for it must be remembered that pus is not in any sense a healing product, its principal office is to protect the new granulations and prevent the absorption through the exposed surface of noxious elements ; and possibly, when containing any considerable number of undeveloped leucocytes, or invisible granules, furnishes the elements for the development of fibrin.

The breast in which a lacteal fistula occurs during lactation, or in which there is a fistula in an active state of

suppuration, should be withheld from the child, and it may be necessary in extreme cases to arrest lactation and hasten the involution of the gland. But inasmuch as these fistulous canals sometimes heal spontaneously after lactation has ceased, it is well to reserve active means of cure until the gland becomes inactive. If, however, the fistula is deep, and shows a disposition to increase in extent, and to involve other than the primarily invaded parts of the gland, the dangers to the future lacteal function of the gland are considerable, and means should be at once taken to stop lactation in the diseased breast; or, if this cannot be accomplished, the process in both organs. It is rare, however, unless through neglect or mismanagement of the primary abscess, that such cases are found, and when they exist, it is generally some time after the establishment of lactation.

But occasionally fistulæ are found at the commencement of lactation, or very soon after, without any of the characteristic phenomena that attend the formation of an abscess. These fistulæ date from a previous lactation, and because they cease to discharge, or continue to discharge only a small quantity of pus—which from an absence of nicety of observation is not noticed at the upfolding of the gland—have led to the impression that a cure is accomplished. Such cases furnish an objection to trusting to the spontaneous cure of lactiferous fistulæ, but I do not, because of such cases, find it necessary to deviate from the already indicated conservative treatment; for it is difficult to understand how such cases can occur if proper attention is given the patient, and an examination of the external fistulous opening made from time to time.

If it is considered advisable to remove the milk from the gland (though generally this is unnecessary, for with attention to diet and disuse of the gland, its function will cease), one of the methods mentioned when speaking of the treatment of absceses may be resorted to.

After the gland has ceased to secrete milk, if the fistula does not heal, it may be treated by first dilating the canal with a sponge, or tupulo tent. When the canal is sufficiently enlarged to admit a small brush, or better, a piece

of wool attached to a flexible sponge holder, or probe, by one of these instruments a few drops of carbolic acid are carried to the bottom of the fistula. I prefer this method to any other for refreshing the inner surface of a fistula. In a few hours a drainage tube is to be inserted to the bottom of the fistula. No other treatment will be called for in the majority of uncomplicated cases of lacteal fistulæ. This procedure is essentially the same as recommended by Mr. Allingham for the treatment of *fistula in ano:* it has proved very efficacious in my hands for the treatment of lacteal fistulæ.

The dressing should consist of some material—it is quite unnecessary to use any medication—calculated to absorb the discharge from the drainage tube. I prefer for this purpose marine lint, or sublimated cotton. Some mild cases of fistulæ may be healed by packing with lint, saturated with carbolic acid, or salicylic acid 1.100, care being taken not to pack too tightly, for by so doing the healing is retarded. The fistulæ may also be packed with finely pulverized boracic acid, or possibly iodoform. The latter I have had no experience with in these cases, for I consider it better adapted to the healing of lesions connected with bone troubles than to wounds of the soft parts, but boracic acid has proved very useful in some cases. With any of these means, pressure, not severe, should be employed. Pressure is conveniently maintained by means of compresses, over which broad straps of Mead's adhesive plaster are secured, care being taken that by pressure the walls of the canal are brought in contact and held in that position.

If these measures fail to heal the fistulæ, it may be necessary to cut out the canal on a director, but this operation should not be resorted to until all other methods of treatment have been tried without success.

The medicines most frequently called for in lacteal fistulæ are *graphites*, *phytolacca*, *calcarea hypo.*, and *sulphur.* I use these remedies from the 3d to the 30th trituration.

C. Galactocele—Milk Cyst.—As a result of a lacteal fistula only the opening of which has healed, or of the closure of a lacteal duct, a cyst may be formed in the

breast, filled with milk or some of its constituents. Both tumors are milk cysts of retention, but differ widely in their pathological anatomy. For it is evident that the cyst which is a dilatation of a lacteal fistula is not in a strict sense a self-supporting cyst. Its walls are composed of connective tissue, and the milk flows into it from the secreting portion of the gland. On the other hand, the tumor formed from the closure of a lacteal duct becomes an independent organ. Its walls are lined with secreting epithelium, and its contents is added to by an endogenous cell.formation of its epithelial cells. The former variety of milk cyst I consider to be always associated with lactation; the latter may be entirely independent of the lacteal process, and may then be looked upon as a circumscribed, spurious evolution of the mammary gland.

Inflammation of the connective tissue walls of the false cyst may cause their destruction, or such a separation of their fibres as to permit an infiltration of the surrounding connective tissue stroma, with the contents of the cyst; or the distension of the cyst may bring about the same infiltration. There is then formed a diffuse galactocele, in which gradually the entire breast becomes filled with milk, the increasing infiltration depending upon the supply from the gland being maintained, the valve-like communication with the fistula remaining open.

The same infiltration may follow traumatic rupture of a duct lacteal cyst, but the supply of milk ceasing with the destruction of the cyst walls, the degree of infiltration is limited.

That infiltration does not always take place as a secondary formatian—the bearing of this upon the occurrence of multiple milk cyst will presently occupy our attention—is probably due to the protective fibrous wall that the inflammation, the initial cause of the tumor, has thrown outside of the sac. This, with the connective tissue, constitutes a firm non-osmotic boundary.

There are thus two forms of lacteal tumors or cysts. The tumor formed in the secreting structure, a true cyst, has its wall lined with epithelium; the tumor formed in

connective tissue is bounded by a strong fibrous capsule, this fibrous deposit being always the result of a certain degree of inflammation and an infiltration of white blood corpuscles. From both of these conditions may result a third, an infiltration tumor, which when circumscribed, has a wall of connective tissue, and when diffuse, has a changing limitation from the same tissue.

The contents of lacteal tumors is usually pure milk, though the milk may undergo chemical changes that render the contents of the cyst semi-fluid, or at times almost solid. Calcification of the contents of the lacteal tumors has been observed in animals, and it is not unusual to find in women concretions and granules in the milk, which from their hardness have been called milk stones. In one case they are said to have given rise to a distinct sound by striking together when the woman moved. In some instances the contents of the tumor disintegrate into a liquid, purely serous; sometimes the tumors are solid, being made up of the creamy or cheesy substances that remain after the absorption of the fluid elements of the milk.

Lacteal tumors are genearlly solitary, though they may follow each other in such rapid succession as to give the appearance of being multiple. It is not apparent why only a single duct of the gland, when the tumor arises from a dilated duct, where there are so many ducts, should become affected at one time. While, however, we find it difficult to explain the rule, the exception, or the multiple lacteal cyst, receives an explanation in what we have already referred to, the formation of secondary tumors by infiltration.

Naturally the secondary tumor will appear near the primary swelling, and because of the condition of the walls of the lacteal cyst, which permit'infiltration, the primary and secondary growths may exist together, at least in the early stages of infiltration. Almost any number of secondary cysts may thus be developed if the conditions for infiltration continue.

Galactocele is generally a disease of lactation, though

not necessarily of pregnancy, for though Sir Astley Cooper believed them always to be associated with pregnancy, beyond doubt sufficient milk is frequently formed in the gland from other causes than a gravid uterus to give rise to a milk tumor. They most frequently occur, however, during the active period of lactation, and at the time of the unfolding of the gland that begins with conception. Dr. W. F. Allen reports a case that occurred sixteen months before child-birth, and continuing without much change during lactation, increased rapidly after weaning. Another case is mentioned by Bouchacaurt of a very large lacteal cyst in a woman fifty-one years of age, twenty-four years after her last pregnancy.

From this the inference may be drawn that lacteal tumors are not dependent upon age, save as this has associated with it the child-bearing period, the period of the functional activity of the mammary gland.

Lacteal tumors rarely attain any considerable size. The noted case related by Scarpa, in which the breast hung down to the thigh, is an exception.

When a galactocele occurs early in lactation inflammation is usually present, but if the tumor dates from before lactation, and its growth is less active, neither pain nor other evidences of inflammation attend its development. The skin covering the tumor at no time presents other than a natural appearance, and there are no changes in the nipple. The breast is soft, except in the region of the swelling, and somewhat flask-shaped. The tumor is fluctuating, and generally situated near the nipple. The axillary glands are not involved, and the health of the patient remains unimpaired.

The etiology of milk tumors that have their origin in closed lacteal ducts is almost identical with certain phenomena connected with lactation. Anything that obstructs the flow of milk through a lacteal duct may be a cause of galactocele. The natural congestion that attends the secretion of milk may, from a slight cause not easily determined, become increased in one of the acini of the mammæ, and this acinus is thereby stimulated to undue

activity, and secretes a larger quantity of milk than can be carried away by the duct, its natural means of exit. The partly stagnant milk becomes by absorption thickened and accumulating, distends the acinus until the muscular walls are paralyzed and no longer able to exert the force necessary for the expulsion of the fluid. Here are all the conditions essential for the formation of a lacteal tumor. The minute lacteal duct is in time completely closed, and a cyst, containing milk, exists in the place of the acinus in which it originated.

It is thus manifest that an obstruction alone is not sufficient to cause galactocele: there is also required a continuation of the glandular activity, a cellular multiplication on the proximal side of the obstruction. This activity of the glandular epithelium ceases when the distention of the enveloping sac has become so great as to cut off the blood supply from the basement membrane, and hence the source of nourishment of the secreting cells. If this anæmia does not take place, and the cellular prolification continues, there are formed the conditions either of the distruction of the cyst or the formation of secondary tumors by infiltration.

The diagnosis of galactocele is sometimes quite difficult, especially when the tumor has become chronic and after it has been subjected to chemical changes which result in inspissation. A tumor occuring during lactation, with no very marked inflammatory symptoms, without pain, in which the superficial veins are somewhat distended, is generally a galactocele, and this history must serve in a great measure to establish the differential diagnosis of lacteal tumors. They appear suddenly compared with the growth of either acute or chronic abscesses and other cysts of the mammæ.

In the first stages they are soft and fluctuating, and only after continuing a length of time do they become solid. They are not associated with a strumous habit and the axillary glands are at no time involved.

The removal of a galactocele is followed by a complete and permanent cure. But this was not true of a case mentioned by M. Velpeau. After removing what appeared

from the analysis of M. Donné to be a milk tumor, the contents of which had become inspissated, at the end of a month, and before the wound of the operation had healed, another tumor developed in the place of the one excised. The second growth continued to increase in size until the whole breast was involved. Fungous growths developed, extensive suppuration ensued, and the patient finally succumbed to the disease.

The opening that follows the spontaneous discharge of milk tumors is rather difficult to heal, and the difficulty increases in direct ratio with the length of time that the tumor has existed. Frequently a fistula is formed that continues to discharge for months, and even years.

a. Treatment.—The treatment of lacteal cysts must vary with the acute or chronic nature of the affection. If the disease is of recent origin, and lactation continues, it will probably be necessary to stop the secretion of milk, for as long as this continues the endogenous cell formation prevents absorption, or if this has ceased there is no reason to anticipate a spontaneous cure.

Generally operative measures have been found necessary to effect a cure. It has been proposed to treat galactocele after the method of treating hydrocele, but the results of opening the tumor with a trocar and injecting some stimulating fluid have not been satisfactory; possibly this is because the lining of a lactiferous cyst partakes more of a mucous than of a serous character. The use of a seton has been followed by more gratifying results; but little inconvenience arises from its presence and its introduction is attended with no danger. Or an incision may be made, and, after the contents of the cyst has been evacuated, the wound kept open with a tent or pledet of lint, or better, cotton wool.

In packing a suppurating cavity it is to be remembered that the best results are always obtained from lightly introducing the wool; the object is not to keep the walls of the cavity separated, but to prevent the surface from uniting, hence it is necessary to insert the packing at the mouth of the opening only.

When the tumor is solid it is better to excise the growth by cutting through the mammary structure down to the tumor: this will be found non-adherent, and easily removed. As a prophylactic, great care should be taken to avoid caking of the breast. The lacteal duct may frequently, certainly in the beginning of the trouble, be opened by judicious pressure from the base of the breast towards the nipple, and the natural flow of milk established.

The medicines that will be found useful are, *Belladonna*, *Bryonia*, *Carbo. veg.*, *Cistus*, *Clematis*, *Sepia*, *Phytolacca*. *Lac. caninum* will assist to arrest lactation; but I have more confidence in *Lactuca* for this purpose. *Asafœtide* may be found useful, especially when the galactocele does not seem to be connected with lactation, and *Calcaria carb.* will be of service when the excessive lactation has induced general debility.

CHAPTER IV.

Diseases Characterized by an Abnormal Growth of one or more of the Mammary Tissues, or by an Increase in the Number of the Histological Elements of the Breast.

The classification of this chapter calls for some explanation, to bring it in conformity with the morphology already assumed, viz., that all pathological processes and growths proceed from physiological states, and that there is not only an absolute cellular continuity in all pathological manifestations, but that there can in no instance be demonstrated a cellular substitution beyond the limits established in the germinal layers.

Reference to the anatomy, the involution and evolution of the mammary gland, will recall in the first instance, that the gland is histologically composed of connective tissue and epithelial cells; and in the second instance, that the most active element in all mammary changes must be attributed to the epithelial cells. That these tissues should increase in bulk, that is grow, without reference to the

functional benefit of the organ, requires no more support than that furnished by daily observation, but that the elements can increase without the aid of unstaple corpuscles, seems to be contraditory to the doctrine of the non-substitution of cells. This however is only a seeming contradiction, for it will be remembered that the connective tissue embraces several varieties of cell type; that fat, cartilage and bone all belong to this tissue, and that any one of these distinct cell forms may take the place of any other form, under conditions favorable to the metamorphosis of the elements necessary for the change. Hence in a strict sense there can be no addition to the histology of the mammæ unless through the agency of disease from without; but clinically speaking a hyaline tumor is an addition to the histological elements of the mammæ; also a carcinonatous tumor presents an intimate structure and cellular type that find no prototype in normal mammary histology, but if these various and remotely removed cell types can be shown to be descendants of the normal constituents of the gland by any of the known processes of cell multiplication, the homogenesis of mammary growths is established.

Between hypertrophies and neoplasms, the distinction is not always well marked, but it is believed that this can be said only of the less clearly defined cases; that the lines are no less broad between hypertrophies and neoplasms than they are between many pathological new formations in some period of their development; and that in the diseases under consideration we have an illustration of the fact that there is a period in the development of all tissues, pathological and physiological, when their future cannot be predicted.

As a simple hypertrophy becomes farther removed from health, it expresses a more profound tumor diathesis, and may express some of the characteristics of a true neoplasm; and a true neoplasm, if not in the individual, in the descendant, may approach normal histogenesis through a gradual return to the simple over-growth of tissues.

A. Hypertrophy.—The most universal law of aggregates,

organic and inorganic, is that they grow; but as in other scientific differentiations it is constantly becoming more difficult to assign limits, to point out boundaries, to say that here one process ends and here another process begins. While to the eye an organ may increase in bulk, and therefore grow, within the wide definition of the term it may be found upon close inspection that the growth is only apparent, that size is sacrificed to solidity, as a dilated heart; or on the other hand an organ may retain its natural size, and upon examination be found to have increased in density, as in the strengthening of muscular fibres from use, or the ossification of cartilage, in both of which examples there is cellular growth without a necessary increase in bulk. In the former, the muscular fibres are multiplied, that is, the muscle element has grown at the expense of the interfibrilar substance; in the latter the increased density depends upon a deposit of calcarious matter between and in the cartilage cells, and the final and entire metamorphosis of the latter: this also is a growth of one group of cells over another group.

While, however, it seems at present impossible to establish a general law of growth, it is convenient and allowable to do so for the individual; and though even in the individual it is indefinite because depending upon such various environments, it may be said that all growth finds its limit in that perfect equilibrium between the organism and its environment, which consists in an impossibility for one to receive and the other to give, more than enough to maintain the state of evolution already attained.

From this it will be perceived that the same laws govern growth that we have found to pertain to evolution—establishment of an equilibrium between an aggregate and its environment. Evolution, which Mr. Herbert Spencer has broadly defined as "a change from a less coherent form to a more coherent form consequent on the dissipation of motion and the integration of matter," and which includes development and growth, has no other meaning and no other purpose than to establish an equilibrium between an aggregate and its environment, that is, adapt an aggregate

or an organism to perform a peculiar function most economically in relation to other functions. Upon this principle the entire human organism is evolved, and when there is a deviation from that type which its persistence permits us to recognize as the most perfect adaptation of motion to matter, of aggregates to their environment, equilibrium is disturbed, and hence the definite use of that form of life interfered with. To this class of derangements belongs hypertrophy, the homologous increase of cells, but it is evident when we consider the effect of use upon an organ or part—to cause it to grow—that it is not always easy to determine when the breast is the seat of hypertropy, and when it is not; if, however, the function of lactation is not benefitted or increased in proportion to the growth of the breast, the condition is one of disease, and is not maintained save at the expense of some other part of the organism. Therefore in general it may be said, that when a part increases to a size disproportionate to the other parts of the body, without a corresponding increase in the functional activity of that part, the organic equilibrium is lost; but on the contrary, when a part, for example the heart—if an obstruction is offered to the circulation of the blood through the system—acquires an unnatural size, and with the enlargement gains additional strength and capacity for action, the part is not diseased, its size is a compensation for some other disease that calls for increased activity of the hypertrophied organ. Neither can the thickness of the skin upon the hand of the laboring man be regarded as disease, for it is an increase of the layers of epithelium to protect the true dermis, and while it is hypertrophy, it is not disease.

The physical processes that induce hypertrophy are the same as those that pertain to the healthy nutrition of the body, the power of individual cells to appropriate an excess of nourishment and subsequently to proliferate. There is reason for believing from the usual circumscribed development of hypertrophy, that the trouble is local, at least in its incipiency; that the disposition and power to continue the use of the surrounding medium—blood—

beyond the time of formative perfection, reside in the cells of which the part is composed; and there is also reason for believing—though this subject will receive special attention when speaking of heterogenous growths—that any considerable departure from the persistent typical form, is accomplished by means of a peculiar variety of cell proliferation, the endogenous cell proliferation; and further, that when an abnormality has its origin in a physiological function, as in the lacteal function, it is always the result of the vacuolation of the physiological cells.

The minute anatomy of hypertrophy of the breast shows no other change in the individual cells by which they may be distinguished from physiological bodies, than in some instances—though this is rare—by an enlargement of the cell area, and possibly, also, as the initial stage in hypertrophy, a change from the normal method of cell multiplication. The entire new formation, compared by Rindfleisch to an organ "defectively built and unnecessary," is distinguished from the surrounding homogeneous tissue, to which however there is not always a distinct boundary, by the crowding together in immense numbers of the peculiar abnormally effected cells, at the expense of the connective tissue which forms their matrix and stroma.

Pathologists are not agreed as to the nature of hypertrophy. Some microscopists, as Harting, assert that there is no numerical increase in the hypertrophy of muscular fibers, referring to the heart; while G. Schmidt stated, that new muscular fibers do arise when the bulk of the muscle increases. Sir James Paget favors the latter view. It is not improbable that both of these conditions obtain in the same growth, and as they frequently pass into each other, the simple and numerical hypertrophy—hyperplasia—may be considered as different stages in one pathological condition.

All cells that go to make up a homœoplastic growth, are not direct descendants of mature similar cells, but it is probable that a considerable part of the tumor is derived from apparently indifferent cells, to which have been communicated the error of nutrition. These cells develop into

elements similar to those that compose the hypertrophied organ, and in turn give rise to its characteristic cells.

The part performed in hyperplastic growths by wandering or mobile cells, is probably, within the limits of cellular substitution, of considerable importance, for the same process, for example, that differentiated the individual epithelial cells that line the mammary ducts from the epiblastic layer of the embryo, may well be believed to be repeated at periods beyond embryonic life. This process of differentiation is also one of evolution, in which the germ does not contain all that the mature organism possesses, but evolves these properties in its progress towards an equilibrium with its environment. We have, therefore, when considering the action of mobile cells in numerical hypertrophy, to deal with indifferent cells, that wander into areas of certain cell influences, and there establish an equilibrium, which results in the development of cells similar to the pre-existing bodies.

The causes of hypertrophy are found in the conditions that regulate the appropriation of nutritious atoms from out of the medium in which the hypertrophied cells exist. But in this there are two forces to be regarded, which mutually aid in the growth of tissues. One force, acting through the cells, takes to itself atoms like those of which it, the cell, is composed; the other force, resident in the environment, made up of various atoms, renders these atoms fitted to the requirements of the contained aggregate —the cell. These conditions of integration must vary with the different means by which the over-growth is accomplished, for whether we can or cannot say with certainty, that this condition induces growth, and this development, that this induces segregation, and this enlargement of individual cells, it is certain that an absolutely uniform force, acting upon an absolutely uniform aggregate, must produce uniform results, and commonly, that variations in the result must depend upon some differences, either in the aggregate or the incident force, caused by the order in which the incident force reaches the different parts of the aggregate.

The instability of the homogeneous, in which "a uniform force produces different changes throughout a uniform mass, because the parts of the mass stand in different relations to the force," has been succinctly discussed by Mr. Herbert Spencer, and also the multiplication of effects in the incident force,—passing from the homogeneous to the heterogeneous, which is the law of all growth. It is therefore conceivable that the same conditions that induce epithelial cells to multiply with unnecessary rapidity, may act upon the intermediary nutritive apparatus in such a manner as to induce proliferation of the cells; that "the same process which afterward furnishes epithelial cells, if interrupted at an earlier stage, must yield connective tissue." The same force having gathered effects, may act upon the individual cell in such a manner as to induce endogenous proliferation. The same force, that is the systemic disposition, may, by the multiplication of effects—and this is accomplished through inheritance—in one body produce a simple hypertrophy, in another body a heterogeneous growth, the tendency of which is towards destruction of life.

The physiological changes through which the breasts pass at puberty, at each menstruation, at each lactation, and at the final up-folding of the gland, are well calculated to set in operation such forces, as on the one hand result in hypernutrition of cells, and on the other hand, develop true neoplasms, heterogeneous growths; but while other growths may have their genesis in causes remotely or not at all associated with the physiology of the gland, it is probable that hypertrophy always finds its initial steps in glandular activity.

This activity does not of necessity occur at periods when naturally the unfolding and up-folding of the lacteal apparatus takes place, but may and frequently does depend upon sympathy with diseased ovaries, and I am inclined to think, as our knowledge of the Fallopian tubes increases, that we will find in their diseases a remote source of many nervous affections, and of diseases of the mammary gland that are not now understood, or attributed to local causes.

To this class belongs mammary hypertrophy that shows itself before puberty, and is associated with delayed menstruation and irritability of the reproductive organs, also the general hypertrophy developed at the establishment of menstruation, the latter function being irregular, and attended with such symptoms as indicate an imperfect ovulation.

Though quite rare, hypertrophy is sometimes connected with uterine displacement and apparently depends upon it. Such a case is reported in the "American Journal of Obstetrics," vol. XIII., p. 187. The mammary trouble disappeared with the cure of the antiflexion and enlargement of the fundus.

Married life and child-bearing, possibly more correctly the function of lactation, must act beneficially upon the physiology of the mammæ, and prove a prophylactic against those diseases that arise in an excessive or imperfect exercise of the lacteal functions; conversely, abortions, sexual excesses without pregnancy, lascivious excitation of the breast, all act as causes for hypertrophy of the organ. A case came under the observation of Mr. Christopher Heath, in which the "lascivious manipulation of a lover extending over many months, induced veritable hypertrophy of the whole organ," upon which "clitoridectomy" had been performed, but without any benefit. These cases of simple hypertrophy are not very rare; they occur in young unmarried girls without apparent cause, though probably an examination of the case would always show some irregularity of menstruation or other source of irritation.

There is no direct evidence pointing to masturbation as a cause of hypertrophy of the breast, but such a possibility should be remembered in seeking the ætiology of obscure cases. It is probable that ovarian irritation may not infrequently be attributed to this unnatural sexual excitement, and by reflex action the breasts participate in the abnormal stimulation.

General mammary hypertrophy sometimes attains an immense size. Manil saw a case at La Charité in a girl of

seventeen years, in which the glands weighed respectively fifteen and seventeen pounds; and the late Sir William Fergusson was consulted by a woman, whose breasts were so large that she gladly submitted to their removal to afford relief from the inconvenience attendant upon their size and weight.

Simple hypertrophy of the breast has no other clinical history than that arising from abnormal growth and the possible tissue degeneration that weight, size and consequent imperfect nutrition would cause, but the abnormal growth of the fibrous tissue of the breast seems in some of its forms to possess a distinct clinical history, to belong in the intermediate zone that imperfectly separates the non-malignant from the malignant growths; for recurrent fibroid tumors, but here we encroach upon neoplasms, while they do not give rise to secondary growths or lymphatic infection, destroy life by repeated recurrence, which is only limited by life itself or by ulceration consequent upon the inability of rapidly multiplying cells to resist pressure and the organic forces opposed to their maintenance.

Any one of the tissues of the breast or the whole organ may become hypertrophied; hence hypertrophy of the breast may be conveniently considered under two divisions:

a. Hypertrophy of the skin and subcutaneous connective tissue—Elephantiasis.

α. Diffuse fibroid hypertrophy of the corium—Scleroderma.

β. Circumscribed fibroid hypertrophy of the corium.—Keloid.

b. Hypertrophy of the connective tissues of the breast.

a. Hypertrophy of the skin and subcutaneous connective tissues.—Elephantiasis.—Two varieties of elephantiasis have been described by authors, E. Græcorum and E. Arabian. Their clinical history and pathology are sufficiently dissimilar to allow of their recognition as distinct diseases. It is therefore with reason that Mr. Morehead and Dr. Fox, following the usages in India, restrict the term elephantiasis to the non-contagious disease

characterized by an excessive imitation in general structure of the outer compact layer of the cutis, and describe the so-called E. Græcorum under the appellation leprosy. Elephantiasis was probably first observed in Arabia, and has been more prevalent in that than in other countries, but at the present day the disease is especially prevalent in Cochin China, the West Indies, Egypt, Barbadoes, Malabar, Abyssinia, Polynesia, South America, Japan and Brazil. No country is absolutely free from the disease. I am not aware that one form of the disease is more prevalent in one country than in another, with possibly the exception of Barbadoes leg.

Elephantiasis is a form of chronic inflammation of the more superficial layers of connective tissue, which in common with other forms of chronic inflammation tends "to the new formation of tissue and serous infiltration." The initial step of the disease is inflammation of the superficial lymphatics which thus become obstructed and fail to discharge their function. The lymph cells pass through the walls of the vessels into the surrounding stroma and there cause the new organization and consequent hardness, which form features of the disease. But elephantiasis is more than chronic inflammation. The endemic character of the disease, its prevalence in the tropics, and the almost complete immunity enjoyed by inhabitants of colder climates, the susceptibility of certain tissues to be attacked, point to something specific in the inflammation. The specific character shows itself in the nodular hypertrophy that accompanies the inflammation, and thenic clial history, which contains a record of oft-repeated attacks of inflammation, each one leaving more or less infiltration and numerical hypertrophy. The enlargement and hardness of elephantiasis are not alone caused by hypertrophy of connective tissue cells, but it is probable that pathology may prove that in a certain measure these are due to rupture of the lymphatic vessels, as in chylacele of the tunica vaginalis.

Elephantiasis is first recognized by repeated and intermitting attacks of inflammation and pain in the part

affected, and general febrile excitement. At first the inflammatory phenomena are situated in the lymphatics, but later the process involves the connective tissue. Sometimes the chronic inflammation is ushered in by acute febrile symptoms, which, however, soon give way to the chronic form.

The relation between elephantiasis and erysipelas, which has been pointed out by Rindfleish, is very striking in the more sudden and violent attacks of the former disease. Both are affections of the lymphatics, and both are accompanied by swelling of the lymphatic glands. The pain, usually one of the first symptoms, if severe in the beginning, becomes less severe with each attack, as the part increases in size. The constitutional and local symptoms usually disappear in a few days, and nothing remains but a slight hardness where the disease was centered. So far there is nothing upon which to form a diagnosis of elephantiasis, for simple chronic inflammation may present similar symptoms. The first positive diagnostic point is found in the return without apparent cause of the inflammation in the part first affected, and again, its subsidence. In some instances, when the hypertrophy has made a certain progress the attacks of inflammation become less frequent or wholly cease to recur, but the increasing size of the part is insured by the constant infiltration of lymph corpuscles. In the later stages the cutaneous covering assumes a pale yellowish or livid color, and frequently becomes scaly, rough or fissured ; soft vegetations which manifest a disposition to ulcerate spring from the fissure, and present an appearance that bears a close resemblance to a malignant growth.

As the disease progresses, deep-seated suppuration, from which flows an offensive discharge, occurs in different parts of the mass, and sometimes in the axillary glands. In the most aggravated forms of the disease extensive sloughing is not rare. The superficial lymphatics are in the most advanced cases usually very varicose, and give rise, by dilatation, to the small quasi-vesicles on the surface of the growth, which are quite characteristic of the disease. The implication of the

axillary glands is not brought about by a secondary deposit of the hypertrophy, for the lymph glands are not affected to a greater extent than to have the flow of lymph arrested in the gland trabeculæ. Probably the remote glandular swelling, as of the axillary glands, which occurs in the more advanced stages of the disease, is traceable to the general degeneration which accompanies and follows the abnormal growth, and it is also possible that the foul discharge that attends the deep ulceration contributes to glandular swelling. This same ulceration is not an essential step in elephantiasis; it is rather the mechanical result of the excessive enlargement and consequent lowering of cell evolution.

Section of elephantiasis shows the epidermis and cutis, and subcutaneous connective tissue to be thickened to the extent of half an inch or more. In the areolæ of the connective tissue is found a semi-glutinous substance, or the whole may be solid, glistening, green like an udder. Sometimes the veins are obliterated, though the arteries are usually very large. Hence when an attempt is made to extirpate the mass profuse hæmorrhage is generally to be expected. The principal nerves present a white, flattened appearance, and are somewhat enlarged. The lymph vessels are found to be enlarged, and to be lined with a dense endothelial stratum, especially the smaller vessels. The cellular proliferation takes place chiefly at the beginning of the lymphatics, the papillary layer of the skin; and to the local cell multiplication may be attributed the nodular appearance of elephantiasis, the excessive local hypertrophy.

Elephantiasis is a very rare disease of the breast. Its most frequent seat is in the lower extremities and genital organs. Indeed, it has been questioned whether the disease ever affects any other part of the body. The breasts acquire an enormous size, the surface becomes hard and rugose, the nipples disappear, and deep ulcerations are found wherever the skin is folded upon itself. The disease may secondarily prove fatal from extensive suppuration and sloughing, though only in the later stages, and after tissue degeneration has taken place, does the constitution in any

way become affected. If the neuralgic pains at the beginning of the disease are very severe the general health may suffer, but this is only temporary, and passes away with the cessation of the pain. In other situations than the breast, elephantiasis is more common in men than in women. I am not aware that elephantiasis has been found in the male breast. It is rare before the tenth year, and most frequent in the usual situation between the age of puberty and the thirtieth year. Lactation, or the reflex reproductive system sympathy, can have no more than a predisposing influence upon the development of elephantiasis of the breast.

a. Treatment.—Operative measures promise very little for the cure of elephantiasis of the breast. The organ may be amputated, but the operation is difficult and attended with danger from hæmorrhage, for the growth is not well defined, and is generally very vascular. The subclavian artery may be ligated * on the side affected as a curative means, or a preliminary operation, but the breasts would still be supplied with blood by anastomosis; and furthermore, the blood is not the cause of elephantiasis. It is however probable, as Dr. Buchanan has suggested in explanation of the cases that are undoubtedly benefited by ligation of the main arterial trunk, that the activity of the absorbents is in inverse ratio to that of the circulation, and physiologically the demand is to restore the action of the lymphatics and so increase the local absorption. This treatment, *viz.*, to increase absorption, can only apply to growths that show no disposition to form secondary deposits, either by infiltration with wandering cells or metastatic growths. Continuous pressure with adhesive straps, or a well-adjusted rubber bandage passed about the chest, may sometimes aid in effecting a cure; but though the progress is unfavorable to complete recovery, the best results will be obtained from internal med-

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* The femoral artery was first ligated for elephantiasis of the leg by Dr. Carnochan, in 1852. Compression was first employed on the femoral artery for he same disease by Vanzetti, in 1869.

ication. In conjunction with the carefully-selected remedy, the diet should be regulated and any tendency to indigestion corrected; and if there is reason to believe that the disease is sporadic in its origin, a change of residence is rendered imperative; it is also important to secure the most perfect drainage; frequent exercise in the open air is also beneficial.

The surgeon may be called upon to decide whether a woman affected with elephantiasis of the mammæ should go through the physiological changes attendant upon pregnancy and lactation. Upon *a priori* grounds, a negative answer should be given, and these are the only grounds upon which to decide the question, for the number of cases reported of elephantiasis of the breast is too small to form a basis for an opinion. Thus, while it cannot be said that lactation tends to increase the connective tissue hypertrophy, it is well known that a physiological function becomes easily perverted, and that where the histological question is one of numerical or simple increase of cells, the conditions that formed the initial step in this action are so closely allied to healthy nutrition that any sudden increase in the latter, even though physiological, is readily appropriated by the perverted cells and converted into the elements for hypernutrition.

a. Diffuse fibroid hypertrophy of the Corium—Seleroderma.—The cutis vera is occasionally the seat of primary hypertrophy, but, as in other histoid growths, the disease may involve other structures, and later lose its characteristic features of location. Seleroderma attacking the breast has been known to pass out of the corium into the interstitial mammary connective tissue, and finally crowd the true glandular tissue out, thus giving the appearance of an almost solid fibroma. There is reason to believe that some of the forms of mammary tumors which M. Velpeau classed under cancer were varieties of seleroderma, or of morphœa. In the light of our present understanding of the essential features of circinoma, malignancy and peculiar cell formation, M. Velpeau's "tegumentary scirrhus, *equirre en curasse*," would be classed with what I have called dif-

fuse fibroid hypertrophy of the corium, and his "scirrhus with fibro-cellular branches, ramose or arborescent scirrhus" with keloid growths.

Scleroderma of the breast begins with a sense of stiffness of the integument and a slight feeling of induration. The skin cannot be pinched as easily as usual, and the diseased area is adherent to the underlying structures. The hypertrophy may attack small spots of various shapes, or the entire integument may gradually become affected. As the disease advances the tissues contract and harden, until a dense, dry, yellowish-white mass has replaced the covering of the gland. There is no distinct boundary to the growth, but both the color and density gradually pass into the healthy tissue. Scleroderma does not confine itself, either superficially or deeply, to the variety of tissue first attacked, but spreads in all directions, wherever connective tissue exists. Beginning on the anterior aspect of the body, it may spread from a small spot or occasionally many centers, until it involves the entire integument of the thorax and back, binding down the muscles of respiration, and thus interfering with the expansion of the lungs. From pressure upon the cutaneous nerves sensation at the height of the disease is seriously interfered with. Between scleroderma and elephantiasis of the breast in its incipiency there are points of clinical resemblance, but it will be remembered that in elephantiasis there is an excessive enlargement of the parts, and with the thickening and hypertrophy of the connective tissue there is an infiltration of lymph. It will also be remembered that elephantiasis attacks the lymphatics.

From morphœa it is sometimes difficult to diagnose scleroderma, for not only are the two diseases quite similar, but frequently appear together, one condition seeming to pass into the other. In typical cases, however, the diseases are quite distinct. Morphœa, described by Dr. Addison and called by him keloid, begins as a single circumscribed, pinkish, hyperæmic patch, slightly puffy to the feel and touch. Around the edge of this patch is observed a network of vessels, which gives the appearance of a lilac

colored ring ; this boundary remains during the course of the disease, even after the center of the hyperæmic patch becomes infiltrated, and depressed. This fibroid hypertrophy frequently follows the course of nerves, leaving depressions between the hyperæmic growths. The disease is usually chronic, but occasionally takes on a spontaneous resolution. There is decided contraction and shrinking of the subcutaneous tissue in the chronic form of morphœa.

Fibroid hypertrophy of the corium usually begins without the knowledge of the person attacked. The initial stages are unattended by abnormal sensations. On the mammæ it is apt to show itself in broad bands, which, by increasing in area, gradually, if the disease runs a chronic course, coalesce into one firm mass. As the disease progresses there may be deep-seated neuralgic pains ; these are not, however, an essential feature of the affection, but depend upon the extension of the morbid process to such an extent as to involve the nerve trunks.

Fibroid hypertrophy of the corium is a disease of early adult and middle life ; it is of very rare occurrence as a primary disease of the breasts. Two-thirds of all cases are found in females, and though it has been known to disappear spontaneously, it usually runs a chronic course, and if the part originally attacked becomes healthy, other symmetrical, possibly remote parts, are invaded by the disease, or the same part may be re-attacked.

1. *Treatment.*—Surgery promises little for the cure of either scleroderma or morphœa. If the hypertrophy is circumscribed and involves but a small portion of the corium, possibly the hypertrophied tissue could be removed or the entire breast amputated, but so much must enter into deciding the course of treatment to be pursued in such a case that is purely individual, that in the absence of experience to serve as a guide—for the number of cases reported is very small—no rules for surgical treatment could be given. In the beginning of the disease, if the first stages are marked by active inflammation, it is probable that belladonna, internally and externally in the form of a poultice, or an ointment might be beneficial. The general health

does not seem to suffer save as a result of the disease, and this is not constant; therefore constitutional treatment is not especially called for.

β. *Circumscribed fibroid hypertrophy of the corium.—Keloid.*—Keloid or kelis is not a typical example of hypertrophy of the fibrous tissue of the skin, for occasionally at the periphery of the growth are observed nuclear spindle-shaped cells around the walls of the vessels, especially the arteries. The sarcomatous elements, however, seem not to be characteristic of the growth, but appear in those portions that have not arrived at maturity, and therefore—though somewhat in opposition to Rindfleisch, who classes keloid with heteroplastic tumors—I have placed them among the hypertrophies of connective tissue, in a more restricted sense, of the corium.

Keloid tumors, were first described as distinct growths by Alibert, who, conceiving that they resembled cancer, a belief in which Velpeau shared, named them cancroid. The correctness of the classification has been disapproved by more recent investigations, and the name keloid, significant of the claws of a crab, is more accurately descriptive of the appearance of the disease. In 1854 Dr. Thos. Addison read before the Royal Medical and Chirurgical Society of London a paper "On the Keloid of Alibert, and on True Keloid." The description of both diseases is clear and concise, and with Dieberg's pamphlet, may be considered authoritative, but it is unfortunate that Dr. Addison should have added confusion to our nomenclature, for his disease, though attacking the same structure as the keloid of Alibert, is very different in clinical and morphological history. I have already referred to Addison's disease under the name of morphœa.

Keloid has been classed among cancers by M. Velpeau, among cutaneous outgrowths, fibro-cellular tumors by Mr. Paget; among fibro plastic growths by M. Lebert; among heteroplastic tumors—sarcoma of the skin—by Rindfleisch; among hypertrophies of the skin by E. Wagner. The growth consists of an hypertrophy of the white fibrous tissue of the corium. This layer of the skin becomes occu-

pied, possibly replaced by thick trunks of connective tissue arranged more or less parallel to the surface of the growth. Warren showed that the disease has its origin in the walls of the vessels of the corium. There the embryonal cells accumulate, and become metamorphosed into connective tissue cells. The spindle-shaped cells, which ally keloid to the spindle-celled sarcomata, are thus made to appear as the initial histological change in the development of this connective tissue growth.

The origin of true keloid, idiopathic as distinguished from traumatic or cicatricial keloid, is obscure; but the situation of the spindle-shaped cells, viewing them in the light of an intermediary tissue to be developed into fibrous tissue upon the walls of the arteries of the corium, and within the reticular tissue in which the arteries lie; the resemblance they bear to the "spindle-celled tissue of recent cicatrice" (Rindfleisch), an intermediary cell form between the tissue of granulation and cicatrices; the fact that they are closely related to the group of inflammatory heteroplasias,—possibly points to their genesis in a local inflammation of the capillary and arterial endothelium, by which spaces, stigmata are formed, through which, emigrate the colorless white blood corpuscles. These corpuscles possessing the capacity, pass through the stages towards organization, rather than in the direction of either involution or of suppuration.

Keloid is first observed as a small, distinct, pale pink tumor, raised above the surface of the skin. As the tumor increases in size it deepens in color, and begins to throw out from different points of its periphery fibrous bands, in every respect a continued growth from the primary tumor. These claw-like projections soon contract in the direction of their long axis, and give rise to considerable deformity. The fully developed keloid resembles an ordinary scar, but is more raised and redder in color.

Keloid is more frequent in the colored than in the white races, and the traumatic variety is especially observed to follow wounds resulting from burns, flogging, the application of acids, and both syphilitic and scrofulous ulcerations.

Keloid is seldom, if ever, the seat of ulceration. It sometimes undergoes a spontaneous cure.

1. *Treatment.*—Keloid is very intractable in its nature, and but slightly amenable to any form of treatment. Removal of the growth, either with the knife or with strong acids, promises nothing, for there seems to be no limit to the number of times the tumor may return after its amputation; the disease, however, always attacks the region first invaded, and does not give rise either to secondary tumors or disease of the lymphatics.

Continued pressure, the electric currents, collodion, with many other local measures, are found for a time warm advocates, but have been discarded as useless, with possibly the exception of electricity. This powerful agent, of which at present scarcely more is known than would serve as an introduction to its therapeutic application, seems to be able to restore morphological equilibrium, and hence bring about a state of health.

I know of no group of remedies acting directly upon keloid tumors, save as the general system is deranged and restored, the growth will disappear. As, however, the general health only exceptionally suffers, there are rarely presented any other than objective symptoms upon which to prescribe. The only medicine with which I have had any success in the treatment of keloid is graphites in the 30th trituration not more frequently than once in 24 hours, and at longer intervals if possible. In the three cases of keloid of the breast that I have treated with graphites, I cannot assert that the disease was cured with the medicine alone, but am inclined to think that a more healthy tone of the system induced by exercise, sea bathing and strict diet were instrumental in bringing about a favorable issue.

b. Hypertrophy of the connective tissue of the breast.—Diffuse fibrous hypertrophy of the breast, diffuse fibroma of the breast, benign induration of the breast (Virchow), as the name implies, attack simultaneously the entire connective-tissue framework of the breast. The connective-tissue cells increase both in size and numerically; there are also found a few spindle-shaped cells.

Hypertrophy of the glandular connective tissue begins in the stroma of the gland, the interacenous tissue. The disease therefore is situated within the breast, though separated from the true glandular or secreting structure. Hypertrophy of the connective tissue stroma by pressure gradually causes inaction of the gland cells, and this inaction their final atrophy. The fibrous tissue, after passing through the various stages of hypertrophy, undergoes a reverse process and contracts. With this contraction of the interstitial fibrous tissue, the glandular tissue having disappeared, the entire breast becomes atrophied. At this stage the organ is found to be reduced in size and indurated, and its glandular structure crowded out by the fibrous structure that now occupies the situation of the epithelial structure.

Diffuse fibrous hypertrophy of the mammary gland is rare. It usually begins in a painful enlargement of the whole breast. The inflammatory features soon subside, but the enlargement remains. These phenomena may be repeated, or the hypertrophy may progress without the stimulus of additional inflammation; the latter is the most usual course.

The impossibility of establishing a clear dividing line between the various forms of pathological new formations is well illustrated when diffuse fibroma is compared with elephantiasis or other varieties of hypertrophy of the subcutaneous connective tissue. All depend upon errors of nutrition, and while one variety may be concerned with one nutritive system, as the lymphatics in elephantiasis, and another variety with an increased supply of blood, there being no considerable involvement of the lymph vessels, features common to all the new formations of a tissue series are recognized. For example, the methods of growth, the complications and the frequent substitution of one form for another form, and of one or more distinct varieties appearing together or developing out of each other.

The diagnosis of diffuse fibroma is in the early stages attended with some difficulty. During the period of inflammation it may be mistaken for simple mastitis, or for

elephantiasis. From the former it is distinguished by the absence of the marked febrile symptoms that accompany inflammation of the breast, for while there is severe local phlegmon, the constitutional disturbance is not marked. From elephantiasis diffuse fibroma may be distinguished by the invasion of deeper structures, by the absence of lymphatic complications, and by the history of the case, which does not show any climatic genesis.

When the disease has reached the stage of contraction, the function of the gland is permanently lost, and unless arrested before this stage, the entire breast being useless, had better be removed, for it is not possible to say how long the growth will remain innocuous.

a. Treatment.—As an aid to the constitutional remedies that must be selected in accordance with general indications, the breast may be well rubbed with glycerine and covered with absorbent cotton, compression being maintained by adhesive plaster braided over the chest; or when this is not considered advisable, the entire chest may be bound with a broad bandage. Belladonna ointment may be substituted for the glycerine when there is the characteristic redness of belladonna; that is, when there are striæ radiating from the nipple to the circumference of the breast. When the fibrous enlargement begins with active inflammation the general and local antiphylogistic measures recommended for mastitis may assist to restore healthy nutrition, and thus arrest the fibrous overgrowth.

B. Neoplasms derived from the connective tissue.—Mesoblastic tumors.—The several varieties of tissue grouped together as connective tissue are more or less passive structures. They form the framework of the body, the fabric upon which the functions and processes essential to life are carried on.

As this series of tissues does not enter actively into the construction of vital organs the pathology of connective tissue does not include a history of marked malignity, save as the tissue elements lodged in the tissue framework are crowded out, or their functions interfered with. This

is true of connective tissue hypertrophy, in which the question is principally one of mechanical development.

The clinical effect is somewhat different when cellular substitution takes place, or when the connective tissue cells retain an embryonal type, that is, remain undeveloped. It is probable that such a morphology is synonymous with whatever of malignancy belongs to connective tissue tumors.

Cellular substitution can take place only between the varieties of a tissue series, but the limits of this substitution in connective tissue is not always capable of demonstration; hence the history of fibroid growths may be obscure, and those cases that present some of the features of malignancy—tendency to recur after removal, with which recurrence there is frequently associated progressive softening of the successive growth, that is, a disposition to return to an embryonic cell type—may begin as a simple overgrowth of the local variety of tissue.

The relation that the connective tissue, the second intermediary nutritive apparatus (Rindfleisch) bears to the other tissue, to support and hold their characteristic cells, as well as the large range of cellular substitution that may take place within this tissue series, is the cause of the very rare occurrence of simple fibroid growths, uncomplicated connective tissue tumors. The stroma of fibromata is more or less associated with mobile cells, especially if abnormally excited; and spindle-shaped cells are also found in various parts of the neoplasm. Thus the histology of fibroid tumors may from the beginning be heteroplastic, or become so by a perfectly physiological infiltration and substitution, at the same time that the growth must be considered as homeoplastic.

Changes in the minute anatomy of connective tissue tumors are especially to be expected in the growths that return after extirpation of the primary tumor. The secondary tumor grows much more rapidly than did the primary neoplasm, and this rapidity of growth necessitates the retention of some of the cell types that naturally precede the fully developed fibrous tissue. Hence a firm fibroid tumor being

removed, the recurring growth becomes less and less firm with each successive recurrence, until finally the tumor resembles the most typical form of embryonal connective tissue.

a. *Fibromata ; fibroma ; fibroid desmoid tumors.* (*Billroth.*)—We are now brought to a consideration of true neoplasms ; of tumors composed of cells differing in type and arrangement from their matrix ; of cell territories, that while they may not be separated from this matrix, are sufficiently characteristic to be always well marked ; of cell centers that are self-contained, that are in a sense independent organisms. At isolated places the framework of the mammary gland becomes, under the stimulus of a peculiar irritation—not generally local, but more usually reflex, and not always known—the seat of a neoplastic inflammation. That this irritation is connected with the period of reproductive activity is apparent from the average age at which fibromata occur in the breast, from the twenty-eighth to the thirtieth year ; but that this cause exerts any special influence in locating the neoplasm in the mammary gland is not probable, for the disease occurs not as frequently there as in other parts. Hence, while the predisposing cause of mammary fibroma may reside in an abnormal activity of the reproductive sphere, we must acknowledge that there is an exciting cause in the glandular function, probably connected with an imperfect evolution or involution of the organ. To the latter process the development of fibroma in the mammæ is more especially to be referred ; for if, as Billroth and Virchow have demonstrated, the younger fibromata show "little connective tissue, but numerous spindle-shaped cells," it is probable that the upfolding of the gland when imperfectly carried on, leaves about the ducts and vascular canals a considerable number of young connective tissue cells that multiply in those places and give rise to a circumscribed tumor.

As the successive stages towards maturity are accomplished by the spindle-shaped cells, and the histological elements increase numerically, the growth, being circumscribed by a limiting membrane, becomes more dense, and

pressing the nutrient channels, infringes upon their caliber until they finally disappear. The same is true of the lacteal ducts; from being the original centers of cell multiplication, they are in time obliterated; and if this occurs during the period of mammary activity, there may follow as a complication of the neoplastic growth dilatation behind the duct, and the subsequent formation of cysts.

The propriety of considering reproductive activity as an essential factor in the ætiology of mammary fibroma is strengthened by referring to a record of fifty cases quoted from Dr. W. S. Gross:

11	appeared	between	10	and	23	years.
18	"	"	20	"	30	"
11	"	"	30	"	40	"
7	"	"	40	"	50	"
3	"	"	50	"	60	"

It has been observed by Dr. Gross that the solid variety belongs more especially to early life, and the cystic to later life, and he concludes that the non-vegetating fibromata, which represent six-tenths of the entire number, are essentially out-growths of the young and active mamma; while vegetating fibromata are out-growths of the mature gland. In the table referred to the variety of tumor is not compared with its occurrence in either the married or single state, or in the barren or those who have suckled their young; but my own experience would lead me to regard lactation, possibly, though less certainly the married state, as a cause of vegetating fibroma, and not necessarily maturity in the sense of years.

Cysts in fibroma are formed in the interspaces of the connective tissue from any cause that induces the accumulation of fluid, and this fluid having accumulated the walls of the cyst proliferate, and the growth becomes vegetating. Lactation presents in a marked degree the conditions favorable to these intra-cystic growths, both during the unfolding, the sustained action, and the upfolding of the gland; but the slight changes incident to menstruation are not alone sufficient to produce such an effect upon a developing fibromata.

In their development fibroid tumors of the mammæ do not differ from fibroid tumors in other organs, nor from the laws that govern the building up of connective tissue, when this follows a normal course. They pass through the same successive stages that take place in the passage from the embryonic to the mature forms. Hence it is observed that fibroid tumors, unless old fibromata (and here especially uterine fibroid growths are referred to), present in the same growth spindle-shaped cells in proportions that vary from an entire exclusion of connective tissue cells to an equal number of both spindle-shaped and connective tissue cells.

The spindle-shaped cells—the histological significance of which is the formative stages of the fibroid growths—are found in greatest numbers at the circumference of the tumor. It is probable that the growth matures from the center; that the spindle-shaped cells are the means by which the neoplasm increases in size, for they in time will mature; and that they are a metamorphosis of the embryonal formative tissue, a metamorphosis that proceeds in rapidity beyond the limits of physiology, and which, in many instances, when once begun, establishes a permanent cell genesis, capable of repeating itself to an extent that is limited only by the endurance of the organism. It is further probable that when a cell type or deviation from physiological cell genesis has thus become received as the—so to speak—physiological pathology of an organism, when the system has become so tolerant of the disease as to continue for a greater or less time a physical unit, that that cell type and cell genesis are transmitted through the germinal elements, and appear in successive generations. This has before been referred to.

Firm fibromata of the breast, as well as when situated in other yielding parts, usually conform to the physical law that for its surface the greatest volume is inclosed within a globe, and assume the spherical form; though, like all histoid growths, fibroma are modified in shape by the parts in which they grow, even though these parts subsequently suffer displacement or entire removal.

Fibromata of the mammæ present a firm, sometimes lobu-

lated, slightly elastic surface. They are usually solitary and situated on the outer surface of the gland, the glandular substance being pushed aside beneath the tumor. They rarely project beyond the surface of the breast, though Mr. Paget mentions a case in which the breast was pendulous and hung down to the woman's knees. Their most frequent situation is at the upper and inner part of the gland, rarely near the nipple, which organ suffers no change in consequence of the histoid growth. The growth is but lightly connected with the underlying structure excepting at its deepest part, and being surrounded with a firm fibrous capsule the contiguous structures undergo no change save one of atrophy. Fibroma is thus seen to be in no sense an infiltration; it is situated within the breast, without forming a part of the breast. The neoplasm is not remarkably vascular, though when large the vessels leading to and from the tumor are considerably enlarged and increased in number.

As a rule fibromata are not painful, and give no annoyance other than that arising from a knowledge of the presence of a tumor. When they have developed previous to pregnancy they increase during the period of gestation, for the same reason that fibromata of the uterus increases at that time—hypernutrition. They rarely, however, diminish in size after the uterine stimulant has been withdrawn.

On section fibromata are found to be white, dense and compact, with interlacing bundles of fibrous tissue, "with a concentric arrangement of filaments around distinct axes." Billroth believes "that this results from the fibrous formation taking place around nerves and vessels, the latter being consequently embedded in the midst of the fibrous layers; frequently the nerves are thus destroyed." The centers around which the filaments are arranged project slightly from the cut surface of the tumor; they are probably the remains of the acini around which the embryonal cells first aggregate. They bear a general resemblance to fibro-cartilage, and their vascularity is in inverse ratio to their density. The tumors are invested with a distinct

capsule of condensed connective tissue, to which the fibrous mass adheres, but which is not adherent to the gland.

When the tumor is less hard a section shows the growth to be composed of bands of young wavy connective tissue and of spindle-shaped cells, interlacing in every direction. The history of the latter tumors shows them to be more rapid in growth and more inclined to degeneration of structure; also more especially associated with malignancy. Throughout the entire life of the simple uncomplicated fibromata the lymphatics remain unaffected, and the skin covering the tumor retains its natural color and appearance. They are usually affected by the menstrual functions, and have been known, though rarely, to diminish in size and wholly disappear at the cessation of the catamenia. I suspect, however, that a proportion of the cases reported as being cured at the final upfolding of the reproductive organs are glandular tumors, between which and fibroma there is striking analogy, but sufficient difference in most cases to establish a diagnosis.

The degenerations and anatomical metamorphoses of fibroma establish the various forms under which they appear in the breast:

α Cystoid.
β Fatty.
γ Myxomatous.
δ Calcareous.
ε Telangiectatic.

α. *Cystoid.*—A very large proportion of all fibroma of the breast contain cysts. This is the most frequent deviation from the typical fibroid growth, and may be considered as almost a necessary anatomical condition when the tumor involves any considerable extent of the periglandular tissue. The method observed in the development of fibroid tumors of the breast, around the acini and nutrient vessels, is strongly suggestive of the truth first demonstrated by Sir B. Brodie, that cysts in neoplasms of the breast owe their origin to ectasis of the lactiferous ducts. At first these to be cysts are fissures or slits in the growing mass,

but in time they become closed by pressure of the neoplasm, and then to an extent dependent upon the preservation of the glandular epithelium, the cavity dilates and a cyst varying in size is formed. Such is probably the mode of origin of all cysts that form in glandular fibroid tumors. Mr. Curling has shown this to be true of cystic diseases of the testes, and observations are not wanting to prove the same of other glandular fibroma. The cysts are oval or spherical in shape, sometimes irregular, made so by the pressure of parts of the tumor. They are usually multiple and vary in size from a millet seed to a child's head.

Their contents is equally various,—sometimes thin and watery, at other times thick and cheesy, and still again, the cavity is occupied partially or wholly by an organized growth which proceeds from the walls of the cyst. These proliferations grow from the epithelial lining of the cyst, and resemble somewhat a polypus.

If the cyst is situated near the surface of the tumor, and this latter is superficial in relation to the gland structure, and if the cyst grows very large and there is such a degree of pressure upon the cyst wall from within that this and the integument are deprived of nourishment, the parts yield and the cyst contents is discharged, leaving an ulcer that requires a variable time to heal, and may possibly lead to further degenerations and tissue changes.

Cystic fibroma grow more rapidly than the solid variety, and also more rapidly than any other neoplasm of the breast. It is not unusual for a cyst that has remained stationary for a number of years to suddenly increase in size and attain a large volume in a few months.

The diagnosis of fibro-cystic tumor of the mammæ rests principally upon the nodular surface of the tumor, and upon a bloody discharge that usually takes place from the nipple. The former diagnostic sign may, however, be deceptive, for if the cyst contains solid matter it may be mistaken for a lobulated growth; the discharge from the nipple, however, when it exists, may be received as conclusive evidence of the presence of cysts in fibroma.

β *Fatty metamorphosis*, *necrobiosis*, is the principal

condition of all cell involution. When speaking of the upfolding of the mammary functions at each menstruation, lactation, and, finally, at the climacteric, reference was made to the physiology of that process, and the important part taken by the fatty metamorphosis of the lacteal cells in bringing about the inactive state of the gland. The same degeneration occurs in all cells, but only to a limited extent in fibroma of the breast, for the change never involves all parts of the gland.

The degeneration begins within the cell, as a reseparation ("Weiderscheidung") of its contents, the "amalgam-like combination of fat and albuminates in the cell" (Rindfleisch). Fatty metamorphosis may precede the disappearance of the neoplasm, for, as with the removal of the hypertrophy of lactation, first by vacuolation, and, finally, lymphatic absorption, so it is possible to conceive of the behavior of fibroma. More frequently, however, the fatty part of the tumor remains in relation to the more solid part, and has the effect of confusing the diagnosis, for it is easy to mistake a fibroma of the breast, in a portion of which fatty metamorphosis has taken place, for cystoma, in which the cyst contains more or less solid matter. The diagnosis will rest upon the shape of the fatty portion, which does not project from the more solid and primary growth, and the consistence, which while soft, does not fluctuate.

The gradual disappearance of mammary fibroma, which has sometimes been observed to take place at the cessation of the frequent renewal and subsidance of the lacteal function, may possibly, in the absence of direct contrary evidence, be induced by fatty metamorphosis.

γ *Myxomatous*, or *mucoid* degeneration of fibroma of the breast, is exceedingly rare, if we exclude those cases of cystic fibroma of this organ in which the cyst cavity is filled with mucus. But it is probable that some of the pure myxomata have their origin in a more solid neoplasm, and are to be looked upon as a secondary metamorphosis of a connective tissue tumor.

The myxomatous degeneration belongs to adult life, and

is a serious complication in proportion to the exactness with which the soft rudimentary fœtal connective tissue is reproduced. The diagnosis is difficult to establish without the aid of the microscope.

δ *Osseous degeneration* of mammary fibroma is not of frequent occurrence; it is found as a secondary process, though its method of development does not differ from the physiological process. In both the intercellular spaces of the connective tissue and the connective tissue cells are occupied, either with the infiltrated salts of lime, or there is active inflammation; the inflammatory new formation calcifying vary much after the manner in which calcareous deposits take place in parts that are hypernourished in consequence of overwork. "The tissues affected are either already necrosed, as in the case of caseous lymphatic glands, dead parasites, thrombi, and dead fœtuses (lithopædia), or have been seriously stinted in their nutrition. * * * The cause of calcareous deposits is thus a local one. The calcium salts dissolved in the blood are not simply precipitated and retained by the tissue, but they proceed to form solid compounds with the albuminoids" (Zeigler).

When this rare form of mammary metamorphose does occur it usually takes place in isolated parts of the neoplasm, so that the tumor presents hard spots—actual calcareous concretions. Such a case is mentioned by Mr. Arthur Durham. The patient was a female, aged twenty-seven years. For two years the left breast had been painful, but the tumor in the same breast was believed to be adenoma. Upon this supposition the growth was removed and found to be "of a pinkish-gray aspect, of softish consistency, except in the middle, where there was a plate of what turned out to be genuine osseous tissue, showing canaliculi and lacunæ." This tumor was probably not an adenoma, but a fibroma that had passed into a mucoid degeneration; at the same time calcification took place in the interior of the growth. Pathological deposits of the salts of lime probably always take place in the interior of the primary growth, in that portion in which

the flow of blood is retarded, where there is a "stagnation of the nutritive fluid."

The diagnosis is not difficult, and rests upon the hard concretion felt within the fibroma, and upon other signs of calcareous degeneration; for it is not probable that a process so expressive of a peculiar diathesis would show itself in one part only; we would therefore expect to find calcareous degeneration of the coats of the arteries and limey deposits about the smaller joints.

ε *Telangiectatic degeneration.*—Next to the development of cysts the most frequent degeneration of fibroma of the breast is the telangiectatic. Fibroid tumors are not generally very vascular, especially the firmer varieties, but they are capable of transforming into a mass of dilated and closely anastomosing capillaries. The formation of these new capillary vessels is similar to the physiological formation of blood-vessels in the embryo, with the exception that blood corpuscles are not developed from the cells that form the canals. The process consists in a vacuolation of connective tissue corpuscles. The vacuolated cells increase in size, and throw out processes that finally unite, the cell cavity being continued in these buds. The remains of the cell wall, which at first divides the process of one cell from the process of another cell with which it has coalesced, is finally broken down and a canal is formed, having branches in various directions. When the telangiectatic degeneration attacks mammary fibroma, the excessive new formation of bloodvessels takes place between the main capillary loops. The diagnosis of telangiectasis, as a secondary disease of fibroma, is not always possible, unless the tegumentary circulation is also involved in the process. When this does not take place, the degeneration is recognized by a gradual softening, without fluctuation of the primary growth. When uncomplicated with cystoma, which, however is rare, for the most frequent seat of telangiectasis is in the vegetations of proliferous cysts, the softness is uniform and does not present any definite boundary. A most important diagnostic mark, because not found in any other pathological formation, is

the compressability of the tumor. By careful manipulation, the blood can be pressed out of the vascular canals, and the tumor partially emptied of its contents, but when the pressure is removed the blood returns, communicating a peculiar sensation of expansion to the hand placed upon the breast. There is frequently a bloody discharge from the nipple, which will vary in quantity with the resisting powers of the capillary walls.

The prognosis of telangiectasis as a secondary growth in any neoplasm, is not favorable. The vascular hyperplasia is a means of hypernutrition, and this opens the door to many of the graver pathological metamorphoses.

b. Recurrent fibroid tumors.—It is still a question in pathology where to place recurrent fibroid tumors. The characteristic that gives them a name would place them among the malignant neoplasms; the minute anatomy of the neoplasms would place them among the great group of fibro-sarcomas. But if we study the morphology of recurrent fibroid tumors of the breast, we find that the primary growth is a fibroma, not to be distinguished from other fibromata, that pursue, an entirely different course; that the anatomical peculiarities connecting them with more embryonic and malignant growths, are gradually acquired through a successive recurrence of the neoplasm, and mark a return to embryonic cell types; a loss at that particular cell center of developmental power. Hence I have placed recurrent fibroid tumors among fibromata.

Recurrent fibroid, or fibro-nucleated tumors, bear a close external resemblance to the simple fibroma, nor is there usually any thing in the minute anatomy of the primary growth, save possibly a preponderance of spindle-shaped cells, that in any way distinguishes them from the more strictly innocent neoplasms; it is their recurrence after removal, what Billroth calls regional recurrence, as opposed to the continuous recurrence of Theirsch, with progressive softening of successive growths, that distinguishes them from other neoplasms.

Unlike the history of other malignant neoplasms, for the possibility of recurrence obliges us to recognize an attempt

toward the development of a malignant growth, that of recurrent fibroid tumors shows that when they do prove fatal, which is not always the case, it is because the system becomes exhausted by the constant demand made upon it, and not because of any peculiar incompatibility between the growth and life, or any disposition for the growth to attack more distant parts through the medium of the lymphatics. The lymph vessels are rarely affected, save in the latter stages of the tumor, when suppuration has occurred, then the pus may, in being absorbed, become arrested in the lymphatic glands and cause their enlargement. Mr. Nunn mentions a case occurring in a woman twenty-eight years old, who had two children. The tumor grew in two years and ulcerated through the skin in eight months; after removal, the neoplasm quickly returned, this time much softer than before. After a second operation the patient died, and a post-mortem showed the growth to have extended through the intercostal spaces, attacking the lungs. At no stage during the progress of this quite typical case was there any enlargement of the lymphatic glands, or any symptoms of a diathesis. In many cases the etiology of simple fibroma, and recurrent fibroid tumors, is identical. The same local error in cell development and growth form the starting point of both neoplasms, but to the recurrent tumors is superadded the enduring quality of its cells, the possibility of establishing at their primary focus of disease a peculiar cell life and history of such a prominent character as to effect whatever cell development may take place in that cell area. The method in which this peculiar pathological cell life is preserved must, to a great extent, remain a matter of conjecture, for the complete removal of every part of the diseased mass, and also of the entire breast, does not insure against a return of the disease, any more than in the case of neoplasms that become constitutional and are repeated through lymphatic infection or specific mobile cells.

From this question of etiology we must at once exclude the possibility of there being any thing in the recurrent fibroid tumor cells that exercise a specific influence beyond

the particular region in which they originate. The inducement to change from a simple fibroma may be constitutional, and Mr. Birkett believes it to be more frequent after the thirtieth year, never having seen a case of recurrent fibroma of the breast in women under that age. But if such a possibility resides in the sum of the operation of the forces of the body, when once established, it becomes local, either in the sense of non-dependence for support upon outside re-enforcement, or of a local error of nutrition, that draws upon the organism, or part of the organism for sustenance.

The first proposition seems more perfectly to explain the phenomena of recurrent fibroma; for there is no general condition associated with their appearance, that could act as a cause of their development; and histologically the office of the connective tissue, and the possibility of cellular substitution within that series of tissues, renders it highly probable that the nidus of disease is not entirely removed, and that something remains to continue the neoplasm.

The progressive softening that takes place with each successive growth, I can not regard as having any special influence in causing their return, for while the neoplasm is quite firm, the primary growth not differing in consistence from the non-recurrent variety, a secondary tumor is as certain to return *in loco*, as after its removal, a tertiary growth appears; moreover, there is sometimes observed in the third growth a return to the primary hard tumor.

The newest part of a tumor, and therefore the part that is most likely to retain the reproductive powers, is situated at the extreme circumference of the growth, and hence may easily escape removal; for as Virchow has said, "the zone produced at the latest period of the disease extends to a considerable distance beyond the zone of degeneration that can be discerned by the naked eye." It, therefore, seems agreeable with what has been observed, that the tumor returns, and this process prevents the cells from reaching maturity, the tendency to arrested development increasing with each successive growth. The cases in which

the growth reverts to the primary cell types, are illustrations of an effort toward healthy morphology.

Recurrent fibroid tumors, especially those that mark the secondary or tertiary growth, and in consequence more closely reproduce rudimental structures, are liable to involve the skin to a greater extent than the simple fibroma. They are also more inclined to ulcerate, and evince a disposition to hypernutrition, in the character of the ulcer that remains. The period at which they return after removal, varies from a few months to one year, and generally lessens with each successive growth.

The microscope shows the recurrent fibroid tumor to be almost wholly composed of spindle-shaped cells, interlaced in every direction. The intercellular substance is generally wanting, the structure being preserved, as such, by the pointed extremity of one cell lying between the bodies of two contiguous cells.

c. The Irritable Tumor of the Breast.—Here again, it is difficult to assign a well defined place in pathological histology to the irritable tumor of the breast. For a careful study of the cases that may be called irritable tumors, leads to the belief that they have no characteristic histology ; that sometimes the growth resembles the painful subcutaneous tumor ; at other times a glandular lobular hypertrophy, and the conclusion is reached that this tumor is not a distinct neoplasm, but that either of the tumors mentioned may assume a neuralgic type. In the first edition of this treatise, the irritable tumor was described as a variety of "lobular imperfect glandular hypertrophy," but a reconsideration of the subject, based upon material accumulated during the time that has elapsed between that edition and the present one, has led to the belief that they are more properly placed among the fibroid neoplasms. They are more frequently fibroid than glandular in structure, and this proportion is much larger if we include all fibroma that are attended with pain and become sensitive to pressure ; but it is not exactly such growths that we mean when we speak of irritable tumors of the breast. We

have reference rather to a small, hard, generally subcutaneous tumor, to which notice is first directed by the sharp neuralgic pains that radiate from that spot. The tumor shows no disposition to degenerate, and does not usually attain any considerable size, but if unmolested, remains for years a source of intense suffering. The tumors upon section, show a dense white fibrous structure. Why they are so characteristically painful is difficult to explain. They not always, indeed rarely, show any involvement of nerve filaments, so that while in some rare cases this may be the cause of the neuralgia, in the majority of cases it is not. It is probable, as Mr. Paget has suggested, that we must attribute the suffering that accompanies these growths to a neuralgic diathesis, rather than to any thing peculiar to the neoplasm.

The irritable tumor is freely movable upon the gland, and shows no attachment to the integument. The tumors are usually multiple, and Mr. Cooke has observed that when single, they are more likely to degenerate than when multiple, but his remarks also refer to hypertrophic tumors of the lymphatic glands. The tumors do not return after removal.

Treatment.—The treatment of fibromata, recurrent fibroid tumors, and the irritable tumor of the breast, naturally divides itself into the employment of therapeutical, and surgical methods. If it can be shown that fibroma is the sum of all the operations of the body, a constitutional disorder, then should we theoretically rely, upon medicines acting through the channels of nutrition to effect a cure; but even if this can be established, I confess to an inability to understand by what means a new formation like a fibroid neoplasm can be removed by medicine alone, save by a fatty metamorphosis of its cells. The fiber cells can not be absorbed as connective tissue cells, and I am inclined to limit the usefulness of internal medication to preventing a recurrence of the disease, or to arresting the growth of the already developed neoplasm. My own clinical experience has not been of a nature to give me much confidence in the power of medicine to remove fibroid tumors; and from

cases that I have been requested to see in consultation with other surgeons, I am led to think that some of the cases reported of cured fibromata of the breast, are not fibroid tumors, but glandular tumors, quite different neoplasms, with a very different history, as will be found when speaking of epiblastic tumors.

I do not remember to have heard of a fibroid tumor of the breast being cured with medicine alone, but they are said to have been removed from the uterus. While however, I would not expect to cure a fibroid tumor of the mammary gland with internal medication, it is good surgery to prescribe according to the individual pathology, and the group of symptoms presented, in the hope that thereby the disease may be arrested and the possibly morbid state, that expressed itself in the neoplasm, corrected, and any tendency to a return of the disease eradicated from the system. The results however of an operation, excepting in the case of recurrent fibroid tumors where the diagnosis rests upon an operation, are so satisfactory, that the tumor should be removed as soon as its nature is ascertained.

d. Gummy Mastitis—Syphilitic Gumma.—Syphilitic neoplasms of the breast are found either as diffuse or circumscribed deposits, that have their initial lesion in a diffuse or gummy mastitis.

It does not seem probable that the diffuse syphilitic mastitis is usually followed by any deposit, though that it may be so has been shown by Dr. Wilks. It occurs during the secondary period, and is attended wiih indolent enlargement of the axillary glands. The diagnosis must rest chiefly upon the history of the case, and upon the knowledge of a primary infection. It may occur in either sex.

The gummy mastitis, or circumscribed syphilitic fibroma of the breast, does not always begin with marked inflammation. Usually the first indication of the presence of the neoplasm is a small hard tumor, situated deeply in the gland; hence the disease may be mistaken for a non-specific fibroma or adenoma, as occurred in the knowledge

of M. Verneuil; or a scirrhous, as in the case reported by Richet.

Inflammatory symptoms mark a later stage of gummata in a large number of cases, and ulceration, with foul discharges, renders the diagnosis extremely difficult between this benign affection, and malignant mammary tumors. Here again, the previous specific history, and like deposits in other organs—which unfortunately for diagnostic accuracy, can not always be known during life—must be relied upon to establish the nature of the disease.

Treatment.—But little is to be expected from operative measures, in either form of syphilitic deposit in the breast. In the gummy variety, when the neoplasms are multiple, and this is of sufficiently frequent occurrence to serve as a diagnostic feature of great value, removal of the mammary growth would be followed by another similar but possibly more degenerated growth at the seat of the operation, and would not arrest the progress of the disease in other organs. The principal reliance should be placed upon internal treatment, and upon such remedies as meet the general symptomatic indications. Should an ulcer form, the best results will be obtained from the use of iodoform powder, with dry sublimated cotton, and compression. Infrequent dressing of the sore is an important element of success, and should be practiced when the discharge is not so profuse as to render it impracticable. If the ulcer requires to be cleansed, corrosive sublimate 1-1000, or in extreme cases 1–500 will yield the most satisfactory results. As in all specific ulcerations, the "wood wool" of Prof. Bruns of Tübingen, makes a most excellent dressing, in the form of a pillow placed over the parts.

e. Lipomata, Fatty Tumors, Adipose Sarcoma (*Abernethy*), *Lipoma Mixtum*, when the investing capsule and entire tumor contain an unusual admixture of fibrous tissue, *Cholestratoma*, when the fat resembles mutton suet, (*Müller*), *Seatoma, Lardaceous Tumors, Speckgèschwülst* (Gluge, Rokitansky), *Fatty Growth* (Rindfleisch), *Lipoma diffusum* (Chilius).

In investigating the nature of the abnormal growth of fat,

we at once encounter a difficulty in determining the boundary to be given to its normal growth ; and we also find that we are dealing with a constituent of the body that in the sense that other tissue cells develop and grow, can not be said to represent either of these processes. For while, for example, epithelial cells appropriate from their environment their proper pabulum, and convert it into the characteristic materials and forms of epithelial cells ; and also during their period of activity possess an inherent power, resident in the living matter of the cells, of multiplication ; the fat cell (more properly vesicle) has received its characteristic contents ready made, as an infiltration ; or the contents of the cell becomes metamorphosed into fat—true fatty degeneration—by an excess of the natural method of forming fat,—disintegration of its albumen,—as one of the steps toward the final dissolution of the organic unit.

There is the further difference between fat cells and other connective tissue bodies, that the former, when fully developed, have so far lost their nucleus, as to render them, excepting in rare instances where the nucleus of the original cell has remained sufficiently intact to take part in the process, incapable of undergoing any of the recognized methods of cell reproduction. Hence we must be prepared to remove from our conception of fatty tumors some of the characteristics of neoplasms generally, that they grow independently of the organism, that they possess inherent powers of development and growth, and to look upon them as accumulations at a given part of the body, of one of the natural constituents of the organism, as an excessive local expression of a physiological process.

Next to adenoma, fatty tumors are among the rarest neoplasms of the mamma. The excessive accumulation of fat in every part of the breast where fat naturally exists, that is sometimes found in elderly women, and even young women who are predisposed to obesity, while not a tumor, and will not, unless in extreme cases, call for more than constitutional and dietary treatment to overcome the general tendency to the deposit of fat, is of interest, because of the possible relation that may exist between that growth

and the fat bodies, which we have seen occupy a position in the evolution of the mammary gland ; and also because of the physiological fatty metamorphosis that accompanies the evolution of the mammary function. Under the influence of the latter functional process excessively carried on, it is probable that in some cases the entire glandular body becomes, through infiltration of its cellular parts, transformed into a mass of fat, thus reverting to a primitive type.

The cause of this over-growth of fat of the breast I am inclined to think is connected in no indirect manner with some derangement of the reproductive organs. Especially in young girls have I observed the coincidence of anomalous ovulation, and this form of obesity ; the actual degree of dependence of one upon the other, it has been impossible to determine.

A circumscribed collection of fat, the true fatty tumor, does not in structure, differ essentially from fat developed in accordance with the typical formation of the body. Physiological fat is usually aggregated into lobules, each with its separate vascular apparatus ; and in pathology, this arrangement is repeated. Occasionally the individual cells are larger, the cell wall having lost its contractility, but in no other particular is this cell unit to be distinguished from other fat cells.

The mass of fat is surrounded by a more or less dense connective tissue capsule, the result probably, of irritative inflammation, or the remains of the alveolus in the connective tissue, in which the process began.

Processes from this capsule, dip down into the soft mass, and divide it into lobules, rendering the tumor more or less firm according to the extent of the intracapsular divisions. The capsule usually remains quite detached from the surrounding tissues, excepting at the deepest portion of the tumor, where the principal artery enters. This vascular trunk passes to the center of the tumor, and from there, growth principally takes place.

As new formed fatty tissue, like normally developed fatty tissue, has its origin in previously existing connective

tissue cells that become occupied by oil globules, so we find that at the center of proliferation there first appears a circumscribed collection of connective tissue cells, which subsequently suffer fatty infiltration; but I do not feel certain that this is the only point at which connective tissue cells become changed into fat corpuscles. The connective tissue capsule may also be considered as contributing from its cells to the primary cellular elements of fatty tumors.

A fatty tumor of the breast is first observed as a small, soft, elastic lump, situated superficially, immediately beneath the integument. Or the growth may involve the submammary adipose tissue, and push the gland forward. The diagnosis in such instances is somewhat embarrassed, since the tumor can not be separated from the surrounding tissues; and it is probable that lipomata having this origin are not true tumors, that is circumscribed, but rather an hypertrophy of fat tissues, possibly a beginning of reversion to the fat bodies. Or again, the tumor may dip down between the lobes of the gland, and, occupying the interlobular spaces, entirely surround the secreting apparatus. The softness, and sometimes almost fluctuation of fatty tumors, may lead to the impression that the grow is of a cystic nature; but the sensation communicated to the finger is peculiar, and was compared by Chelius to that experienced when pressing a bag filled with cotton, and the surface is in general lobulated and uneven; moreover, as M. Velpeau has observed, the circumscribed subcutaneous fatty tumor projects more perceptibly from the gland, than would a cyst of equal size, and the skin covering a fatty tumor is more natural than the skin that covers a mammary cyst.

There is a peculiar appearance of the integument covering fatty tumors when situated superficially in other parts, which, though I am not aware that it has been observed in mammary lipomata, may serve to establish a diagnosis. I refer to the fact first mentioned by Schule, that the capsule of this tumor is more closely connected with the skin in the interspaces between the lobes and the growth, that is

to say where the partitions came off from the capsule, than in other parts, and hence the tumor is seen to be covered with depressions.

Fatty tumors are not usually attended with much suffering; but if they attain a large size, the weight alone will be sufficient to give rise to considerable annoyance, and the pressure upon nerves, to actual pain. The general health is not affected primarily, but if the tumor ulcerates, then suppuration, which is sometimes profuse, may be the cause of considerable general debility. Fatty tumors grow slowly, and after attaining a certain size may not change for an indefinite period, or they gradually increase through a period of many years, until they attain an enormous size. Sir Astley Cooper removed one from the breast of an otherwise healthy woman, that weighed over fourteen pounds.

So characteristic of fatty tumors is slowness of growth, that when one of these recognized neoplasms is ascertained to have grown rapidly, we may quite positively assert that we have to deal with some complication of lipoma, probably the cystic.

Fatty tumors are not always found at the place where they begin to grow, but frequently change their position, so that one originating in the neck may be found in the breast. It is difficult to understand how the migration of fatty tumors can take place while the central vascular stem retains the office of the principal nutrient canal. Either the stem must become elongated, which is not probable, or through some local agency, becomes obliterated, and finally separated from the growth, which being no longer held in position by this stem, follows the law of gravitation, and descends, establishing new vascular connections as it travels. This is the more probable of the two hypotheses, and we would naturally expect to find that the migrated fatty tumor was more susceptible to degeneration than the one that retained its original vascular supply. I am not aware, however, that clinical experience sustains this expectation.

In the degeneration of lipoma the fat cells remain

entirely passive. Either their contents become chemically acted upon, as in mucoid degeneration, when *necrobiosis* obtains; or the source of nourishment being withdrawn the tumor dies, as in ulceration, and degenerates into inflammatory products; or, again, the connective tissue stroma is primarily the seat of infiltration, as in calcareous degeneration. It thus appears that the fatty growth itself is the first step in the successive stages of degeneration, which ultimately in many cases, leads to some degree of destruction of the mammary gland.

α Mucoid.
β Cystic.
γ Calcareous.

α. *The mucoid metamorphosis* of lipomata is a retrogressive process. By it a part of, or the entire fat tissue becomes transformed into a mucoid substance. The original tumor begins to soften and enlarge, and when cut into presents a jelly-like mass containing mucine. In this process the connective tissue stroma takes part, so that when the myxoma is fully formed, there is a complete *necrobiosis*, the original structure having given place to the more primitive tissue.

The process by which pathological mucoid metamorphosis is accomplished, probably does not differ essentially from the physiological process that takes place on mucous membranes when mucus is secreted, save as the tissues vary that undergo the softening. For the formation of mucus, whenever it occurs, is a chemical process, mucus not existing, as such, in the blood; and it is evident that as mucus must be regarded as a local product, there will be differences between the process as it takes place in epithelial cells, where the cell perishes frequently, though probably not necessarily, in the act of giving up its contents, and the process as it takes place in the tissue we are studying, where because of its incapacity for resorption, mucus must remain at the place it is formed until removed by further metamorphosis.

From the quality of absorbing fluids, that mucus possesses in a marked degree, there arise certain clinical features

of value in the diagnosis of this softening of fatty tumors. When speaking of uncomplicated fatty tumors of the breast, emphasis was laid on the diagnostic importance of the slow growth of this neoplasm, and it was then said that a rapid growth in a tumor known to be composed of fat, pointed to some complication, probably cystic. This is also true of mucoid degeneration, for here the increase in bulk does not depend upon cellular multiplication, or upon the size of each individual cell,—both of which processes require for their accomplishment, to pass through definite changes, which biological changes consume a considerable length of time ;—but is brought about by the capacity of absorbing, and this takes place more rapidly than any physical changes can take place.

The diagnosis therefore of mucoid degeneration of lipoma, rests principally upon the rapid general softening of the hitherto doughy tumor, but it must be stated that the crucial test can be applied only after an operation.

As the mucoid degeneration has not been known to return after removal of the neoplasm, the most rational treatment is an operation; and inasmuch as the fat mass having at one spot shown a possibility of degeneration, may repeat that metamorphosis at other points, the entire abnormal accumulation, and possibly the whole breast, if the question of lactation is not to be considered, should be removed.

β. *The Cystic Degeneration* of fatty tumors, is of frequent occurrence. It results probably in most cases, from mucoid softening, that becomes circumscribed, or is limited by the connective tissue stroma of the fatty mass, which in its turn constitutes the capsule, or cyst wall. From the inner surface of the cyst wall the intra-cystic growth not infrequently receives additions to its bulk. The cysts may be multiple, or more rarely single, but in either case call for interference. If the cyst is single and superficial, the attempt may be made to destroy the cavity by removing its contents, and treating the wound as an open one, with injection, drainage, etc., but this conservative method will cause disappointment, for if the cyst operated upon is

cured, others are likely to form in different parts of the tumor. The most truly conservative practice, when treatment is called for, is to remove all parts that may suffer further degeneration.

γ. Calcareous Degeneration of fatty tumors, affects chiefly, if not alone, the connective tissue stroma of the neoplasm. The process is to be referred to one of infiltration of the connective tissue cells with the phosphate and carbonate of lime, to such a degree as to form a calcareous net-work within the tumor, which gives hardness and considerable weight to the growth.

The disposition of the fat corpuscles, after this infiltration has taken place, is not always the same. They usually change into an oily fluid, which, as the calcification proceeds and encroaches upon the spaces between the stroma walls, is gradually removed, and absorbed into the circulation as fat.

Calcification of a tumor carries with it the destruction of the growth: for if this is of a vascular variety, the very means of the limy infiltration, the nutrient canals, are finally obliterated, and the tumor perishes from starvation. It is probable that the initial step in calcareous infiltration is hypernutrition; and hence the calcification of lipoma is found to follow, or accompany inflammation of a passive type. The process described as involving the interior of the fatty growth, is repeated at the edges of the ulcers that remain when the integument breaks down from subtegumentary pressure. There is then formed a calcareous ring, surrounding the entire ulcer.

Fatty tumors rarely show any disposition to ulcerate, that can not be traced to withdrawal of nourishment, frequently induced by the enormous size and dependent position of the growth. But these causes are not likely to act upon fatty tumors situated in the breast. On the contrary, the ulceration is more liable to first attack the integument covering the tumor, and from thence to involve the deeper structures, which may then become gangrenous. The causes of this breaking down of tissues are found in the

pressure exerted on the integument by the increasing size of the tumor, aided possibly by some local injury, invited by the prominent position of the tumor. The ulceration however, is never of a malignant nature, and will yield readily to treatment, but the propriety of removing the abnormal growth, if the operation has been delayed until the breaking down of tissue begins, can scarcely be doubted.

f. Sarcoma.—

Until recently, much uncertainty has existed as to what we shall recognize as sarcoma. Because of its widespread genesis in any structure belonging to the connective tissue series, the term has been used as an affix to the tissue in which the neoplasm originated, descriptive more of a complication, than of a well defined histoid growth ; but pathologists are now quite well agreed in considering those tumors sarcomata that histologically are made up of embryonal connection tissue, that shows no disposition to pass to the higher tissue forms, but rather to retain the embryonal type, or to degenerate.

Sarcomata, above all histoid growths, in their development represent most closely an entire reparative process. The constituents of the round celled sarcoma are almost identical with the upper layer of granulation tissue, and the several stages through which the white blood corpuscles or leucocytes,—in one instance pass toward the organization of reparative tissues, and in the other instance toward the more fully developed connective tissue cells,—reach the place at which evolution ceases and proliferation begins without limit to growth, can not be distinguished.

Both the white blood corpuscle and the connective tissue cell are connective tissue products, and belong to the mesoblastic layer ; and it is probable that the multiplication of connective tissue cells, which constitutes the initial histoid change in the development of sarcomata, is instituted by causes differing in degree only, from those which under conditions calling for the repair of tissue, would result in the formation of granulation tissue, inflammatory new formations.

It is not however, intended to express the opinion that between sarcomata and inflammatory new formation there is not sufficient difference to distinguish one from the other ; what we do find is, that granulation tissue is built up from white blood corpuscles that have passed through the capillary and venous walls, these corpuscles being identical with the wandering connective tissue corpuscles ; that the embryonal connective tissue that constitutes a phase in the history of granulation tissue, is developed from the leucocytes that occupy the extra-vascular structures, and that, if development is arrested at this stage, we have to deal with a structure that can not be distinguished from the characteristic sarcoma tissue. On the other hand, the ætiology of the histoid growth does not include the deterioration of the vascular walls, that forms an essential feature in the history of inflammation, nor does there exist that balancing power between the cell and its environment, which must regulate physiological, tissue transformations.

The vital endowment of the embryonal connective tissue cells that constitute sarcomata, is of a nature to favor their proliferation as embryonal types, and to oppose their higher development. We have, therefore, in sarcoma a neoplasm composed of embryonal tissue, developed out of and situated in a matrix of mature tissue forms ; a mass of tissue that may represent an arrest of development toward more stable forms, or a retrograde histogenesis.

The causes of sarcoma are those relating to the multiplication and growth of cells ; and since it can not be demonstrated that external stimuli alone are capable of causing cell proliferation (Ziegler), we must seek in the vitality of the bioplasm, which enables it to appropriate in excess the stimuli and pabulum that induce multiplication, the cause of the growth of sarcomata. Of the nature of this, as of all vital phenomena, we are ignorant. We at best can study only the effects of a cause that we have no means of investigating.

A section of a mammary sarcoma favors the suggestion that sarcomata of this gland have their origin in the endothelial cells of the connective tissue stroma of the

mammæ, and also it seems to me probable, in the endothelium of the vascular tubes that surround the secreting structures. It is, however, probable that the migrated white blood corpuscles also contribute to the building up of the embryonal mass. The appearance presented by the cut surface has been well compared by Virchow to the structure of a divided cabbage-head. The irregularly shaped lines are in reality clefts, the altered and compressed remains of lactiform ducts, still however, lined with cylindrical epithelium, but this epiblastic product takes no part in the morbid process ; it seems to remain inactive unless instrumental in the formation of the cysts that are frequently found in sarcomas.

The organization of a vascular system for sarcomata, repeats the process known to take place at the first appearance of blood vessels in the ovum. The vascular system is of mesoblastic origin, and hence we find that mesoblastic neoplasms have the capacity of an excessive vascular development.

At the margin of a growing sarcoma is found a variety of cells in transition stages ; cells that show an origin from normal connective tissue bodies, and others that have proliferated from already diseased cells. We thus perceive that sarcomata show rather a peripheric than a central growth ; and hence, as the neoplasm increases by the degeneration, so to speak, of contiguous parts, as well as by the proliferation of already existing embryonal forms, the tumor has no fixed boundary, and may gradually, though sometimes rapidly, involve the entire organ in which it began as a small growth ; when, however, the neoplasm has ceased to grow and is mature, the tumor is more or less sharply defined from its matrix.

The texture and appearance of a sarcoma vary with the quantity and character of the intercellular growth and the constituents of the cells ; the latter chiefly serve to distinguish the several forms of the neoplasm ; but while the cells furnish the histological diagnosis, the intercellular substance determines the color and consistence of the tumor. The richer the growth is in cells, the more soft and marrowy

and grayish is it found to be upon section ; and conversely, the poorer in cells, the firmer and more fibrous is the growth. The latter pass into fibromata ; but as many sarcomata show at one time in their different parts almost every variety of cell characteristic of this metaplasia, to distinguish between the sarcoma and fibroma, and between the several varieties of sarcoma, sometimes involves a question of relative development that it is not always easy to answer.

The two principal forms of sarcoma, the round-celled and the spindle-celled, have been found in the mammary gland ; of these, however, there are several varieties, that are certainly very rare, if indeed they should be classed among the neoplasms of this gland.

a. Round-celled Sarcoma.

aa. Small Round-celled Sarcomata are composed almost entirely of round cells having little protoplasm, but with a highly developed oval nucleus, and vessels that occupy thin walled channels between the cells. The connective tissue framework is scanty. Lymphoid elements, distinguished from other elements of the tumor by their deeper staining, frequently exist with the connective tissue cells.

The physiological prototype of this variety of sarcoma is found in granulation tissue. A section of a small round-celled sarcoma shows a white, milky surface, sometimes cheesy, from which a milky fluid can be scraped.

Lymphosarcoma resembles the small-celled variety in the character of its cells, but the structure is built upon the pattern of the lymphatic glands. The small round-celled sarcomata belong to the class of highly malignant neoplasms. They grow very rapidly, and exhibit such a tendency to metastatic growths that these may develop in every part of the body, in a short time after the appearance of the primary tumor.

ββ. Large Round-celled Sarcomata are distinguished by the size of the cells, which contain much protoplasm, and are supplied with large oval nuclei ; the cells are both binuclear, and multinuclear. The stroma is more abundant than in the small round-celled sarcoma, and is largely made

up of spindle and round cells, though these in turn are observed to be held in a net-work of connective tissue. The cells vary in size, the tumor frequently presenting a mixture of small and large cells ; the cells also vary in shape, and may, with propriety, be called polymorphous.

The prototype of the large round-celled sarcoma—though if we include in the name a definition of all the elements of the neoplasm, we would more justly call it the polymorphous celled sarcoma—is found in the medulla of the fœtus, but even these cells are not as large as the sarcomatous bodies sometimes appear, which have been known to contain more than thirty nuclei. To the sarcoma, in which the large round cells predominate, but in which there is also an admixture of giant cells and polymorphous cells, the name *myeloid sarcoma* has been applied.

Large round-celled sarcoma grow less rapidly, and show less tendency to secondary growths than the small round-celled tumors ; they may therefore be ranked as in a less degree malignant.

Alveolar Sarcoma may be considered as a variety of large round-celled sarcoma, unless with Ziegler we class it among "Sarcomata of peculiar type," an apparently unnecessary addition to our nomenclature of tumors. Alveolar sarcomata are very rare in any tissue. I have not found one well authenticated case occurring in the breast. It seems probable, however, considering the endothelial type that the cells of this neoplasm retain, by reason of which anatomical arrangement, it becomes at times, and in portions of the tumor, extremely difficult to distinguish from carcinoma, that this form of sarcoma has been mistaken for carcinoma of the breast, in more than one instance. There is one histological characteristic that will surely establish the diagnosis. In alveolar sarcoma the cells are intimately connected with the fibers of the connective tissue stroma, at once classing these among connective tissue growths, while the reverse is true of carcinoma.

Alveolar sarcomata are built upon the model of glands. The cells, which closely resemble the glandular epithelial

cells, lie upon a fibrous net-work in which the bloodvessels ramify.

The cells are occasionally in direct contact with each other, there being an entire absence of connective tissue. The bloodvessels, while they do not enter the cell group, form plexies, the intervascular spaces of which are occupied by the endothelial cells.

β. Spindle-celled Sarcomata are composed of long nucleated cells, the ends of which are received in the spaces formed by the processes of two other cells. These spindle-cells are arranged in groups of more or less regularity, sometimes taking the bloodvessels as a point around which to center. A connective tissue stroma is generally wanting, and rarely developed to any extent. The spindle cells vary in size in the same tumor, and while this variation is sufficient to make the same division as is found in the round-celled sarcoma—small and large celled—the histologically different elements are mingled in such proportions that separate tumors, distinguished by the size of the cells, can not be recognized among the spindle-celled sarcomata.

Spindle-celled sarcomata present a grayish yellow, transparent appearance upon section, or, when the development of the vascular system is excessive, they show various shades of red. The tumors are quite firm in texture, grow less rapidly than the round-celled sarcoma, and show less disposition to secondary deposits. I find myself in agreement with Billroth, who places the physiological type for spindle-celled sarcoma in young, not embryonic, muscle, and nerve tissue.

Sarcomata of the mammæ appear usually as solitary, smooth, sometimes bossed tumors, situated either near the nipple, or at the upper and inner circumference of the gland. They increase in all directions, and show a marked tendency to reach beyond their capsule, sometimes involving the entire gland by means of extending along the smaller vessels.

Both breasts may be the seat of the neoplasm, or several growths may exist in the same gland. The axillary lymphatics are not usually involved. In this connection it will be remembered that sarcomata grow in the direction of the

veins, and not of the lymph channels; we can not therefore regard the secondary sarcomatous tumors as the result of an absorption from the primary growth of disease producing elements.

Secondary sarcomata usually develop in internal organs, and may be looked upon either as independent *foci* of disease, or as infiltrations from the primary neoplasm; possibly also in some instances the secondary tumor, when near the primary growth, may arise from spreading of the disease along the blood vessels. The comparative immunity from infection of the lymphatics in sarcoma, at once establishes a valuable distinction between these and all other malignant tumors, and raises the question whether we are not to regard sarcomata as the expression of a constitutional tendency to the retention of embryonic cell forms. To Cohnheim belongs the honor of proposing this hypothesis, but he would see in it the ætiology of all tumors. It is not necessary that the cells or group of cells that retain their embryonic form and are only stimulated to proliferate, should persist in the germinal spot which later gives rise to the organ in which the sarcoma is found; for by reason of the amœboid quality which these cells possess, they migrate to a spot where there is the least resistance to the persistence of their embryonic forms.

In the beginning of mammary sarcomata, at which time they generally increase very slowly, there is little if any pain present; but later, when the tumor receives a fresh impulse to grow, the pain becomes quite severe; not the sharp lancinating pain of scirrhous, but a dull local pain, that does not spread to the axillary lymphatics, or matrix of the neoplasm. Occasionally sarcomata increase during menstruation, and return to their former condition when the period has passed.

The skin covering mammary sarcoma, especially if the tumor has grown rapidly,—hence we are more concerned with the small round-celled neoplasms, and in their latter stages—shows a disposition to degenerate. The degeneration is not from spreading of the growth to the integument, but probably arises from pressure, and interference with

the nourishment of the tissue that covers the tumor. There seems to be first an arrest of the flow of blood, shown by the turgid state of the bloodvessels, followed by total obstruction, giving rise to ulceration and finally gangrene of the tissues. From the destruction of the integument thus resulting, there protrudes a fungus mass, that resembles granulation tissue in a highly vascular state. The discharge is extremely fetid; the border of the ulcer is neither discolored nor attached to the fungus, nor does the ulcer show any disposition to heal.

There is frequently a muco-serous liquid discharge from the nipple, the secretion of the altered and compressed structures, which, as in other mammary tumors, is a diagnostic sign of the development of cysts of retention; but for some anatomical peculiarity that opposes the emptying of these cysts through the remains of the lacteal ducts until the pressure of the accumulation is sufficient to force an opening, the discharge is liable to be intermittent. When the discharge ceases, the tumor increases in size, but again undergoes reduction when the discharge begins. It is not unusual for these changes to be associated with the performance of the menstrual function.

Sarcomata are liable to the same degenerations and metamorphoses that occur in other neoplasms.

a. Cystoid.—The most frequent metamorphosis of mammary sarcomata is the cystoid. To such a degree is this true, that the contrary proposition forms the exception. It is indeed probable that at some stage in their growth all mammary sarcomata are cystic, and that if later this feature does not occupy a prominent place in the anatomy of the neoplasm, or has wholly disappeared, the change is brought about by crowding of the proliferating cells upon the caliber of the lacteal duct.

Cysts of degeneration arise in sarcomata from softening that begins in the center of the neoplasm, and has no connection with the glandular parts. These cysts contain a mucoid substance, *myxosarcoma*,—or a fatty fluid, and do not usually discharge their contents from the nipple. The diagnosis of cysto-sarcoma, will therefore rest principally

upon the rapid increase in the size of the tumor, a sensation of fluctuation in the tumor, which can not be attributed to the fluid resulting from inflammation; and when the cyst is one of retention, an exudation from the nipple of the contents of the cyst. To these objective signs may be added a bossed appearance and feeling of the surface of the tumor, found when the cysts are near the boundary of the growth, and quite small.

β. Telangiectatic, *myxomatous*, *fatty* and *calcareous* metamorphoses also take place in mammary sarcoma; of these the telangiectatic development is especially deserving of attention.

The same processes are followed in the development of new vessels, and of embryonal connective tissue, as take place in the normally evolving embryo, to form its vascular system. The cells, by rearrangement, make up the vascular walls, and finally the entire neoplasm becomes a network of vascular tubes, with very slight extra-vascular tissue. The sarcoma thus changed, assumes a dark red or purple color, that can be observed on the surface of the breast. Upon section, there is presented to the eye little else than the open mouths of vessels. If the growth has existed a length of time, the tubular form of the vessels may be lost, and the tumor be composed of variously shaped cavities. Of this tumor the physiological paradigm, is found in the *corpus cavernosum penis*.

If a sarcoma that has suffered telangiectatic metamorphosis from mechanical or other reasons, becomes ulcerated, the danger lies in the excessive hemorrhage that may follow, and calls for the immediate removal of the breast, for it is difficult if not impossible to otherwise control the flow of blood.

Of the other metamorphoses mentioned, the names are sufficiently descriptive. The processes by which they are accomplished do not differ essentially from those already described in other neoplasms, neither do their clinical features present differences peculiar to their sarcomatous origin.

Sarcoma of the mammary gland occurs most frequently

in young married women. It has been observed in young virgins, but it is extremely rare in either the married or unmarried, after the fortieth year.

An analysis of sixty cases given by Dr. W. S. Gross, shows that sarcomata belong essentially to the active gland; that spindle-celled and cystic sarcoma develop in the mature gland, and that round-celled, and firm or solid sarcoma, belong to the folding up glandular function.

These facts, when placed by the side of what, on the one hand, we know of the genesis of sarcoma, and on the other, of the evolution and involution of the mammary gland and its connection with the functional activity of the ovaries, afford support to the hypothesis that the development of sarcoma of the breast depends to some degree upon the health of the reproductive organs. The spurious unfolding and upfolding of the mammary function that occurs at every menstruation, or what is within the realm of probability at every ovulation, processes not necessarily connected with menstruation, are, especially the upfolding process, fruitful sources of that oft repeated irritation which has been found to form the nidus for the development of sarcomata in other parts of the body. There are also here to be considered the waste cells of the spurious lacteal process, not alone secreting epithelial cells, but also leucocytes that wander into the surrounding connective-tissue, and there under favorable conditions proliferate, forming an embryonic mass, in a matrix of mature tissue.

The prognosis of mammary sarcoma will usually vary with the pathological histology of the neoplasm, though the anatomical constituents of the growth, that is to say, whether it is round-celled, or spindle-celled sarcoma, do not seem to exert as much influence upon its history of malignancy, as does the proportion in which the constituents are mixed,—its consistence. Generally, however, the round-celled sarcomata are softer than the spindle-celled growth, more rapid in their course, and more favorable to the development of secondary tumors in internal organs.

The rapid growth of a sarcoma is an unfavorable symptom,

and may reasonably form the basis of a grave prognosis, unless the increase in size is caused by the accumulation in a retention cyst. These cysts make the prognosis slightly more favorable, but it is different with the cysts resulting from internal softening of the sarcoma. The latter metamorphosis is generally the beginning of the degeneration of the entire growth, and is to be looked upon as a serious complication of the primary neoplasm.

Sarcomata usually develop in strong, apparently healthy persons, the first evidence of the constitutional possibility being the presence of the tumor. Extirpation is usually followed by regional return of the growth in less than a year, the second tumor being softer and containing less connective tissue stroma than the one excised. Extirpation is also frequently followed by the development of sarcomata in the lungs and other internal organs. These, with suppuration of the primary, or recurrent growth, induce marasmus, from which the patient dies.

Billroth has called attention to the clinical difference that exists between the return of sarcoma, and the return of carcinoma after extirpation. The former is regional, in or near the cicatrix; the latter is continuous. An explanation of this difference is to be found in the peculiar methods by which the two neoplasms spread, sarcomata by means of the veins, carcinomata by means of the lymphatics; and also in the pathological histology of the two growths, it being possible for sarcoma to develop in the process of the evolution of connective tissue elements; while carcinoma, which partakes of the nature of an infiltrated growth, that is, has no definite boundary, arises from epithelial cells, and being more circumscribed in its area of development, but more wide spread in its possibility of growth, is thus almost of necessity a continuous neoplastic process, the recurring tumor being developed from some part of the primary growth that has remained after the operation for its removal.

Notwithstanding that sarcomata return after extirpation, and that their removal seems frequently to be followed by a visceral development of the same neoplasm, extirpation

is the best treatment for the rapidly growing sarcoma of the breast. While the tumor remains small and inactive, at which time a diagnosis is very difficult, there is little reason to believe that the internal organs are also attacked, and that secondary tumors are forming in any part of the body. This period, if it can be taken advantage of, is the most favorable for operating, but we must not hesitate to extirpate the growth at a later period of development, for though the disease will probably prove fatal, life may be prolonged, and in comfort, by an operation.

In operating for the removal of mammary sacoma, the entire gland should be removed, with any connective tissue that seems in the least diseased, or likely to have been infected by the sarcomatous degeneration.

g. Myxoma, or Mucoid Tumors.—There are two forms of myxoma; one, and to this only should the name be applied, is composed entirely of mucous tissue; the other is a condition of involution of one of the connective tissue series. To the latter, Johannes Müller has applied the name *Collenoma.*

Both these neoplasms are extremely rare in the breast, and it may be questioned whether some of the cases reported as myxoma of the mammary gland were not first fibroma, or lipoma, that during that state of development escaped observation, and have become œdematous, thus assuming the character of mucoid tumors. These tumors are not wholly composed of mucous tissue; the areolar connective-tissue base can constantly be made out, and is sometimes coarsely fibrous.

If the histological origin of the myxomatous tumor can be ascertained, the name *myxofibroma*, or *myxolipoma*, would be accurately descriptive of the neoplasm, but this can not generally be told before applying the microscopic test, and hence we must call those tumors myxomata that contain a preponderance of mucous tissue.

In no mesoblastic neoplasm is the embryonal type more clearly retained than in myxomata. In them we have represented one of the earliest stages in the development of connective tissue, the "pellucid jelly and nucleated

corpuscles" out of which the several forms of connective tissue are evolved ; forms that are determined by the preponderating development of one or the other of the component parts of the soft matrix.

The histology and ætiology of myxoma, therefore, are seen to very closely approach what we know of the history of fibroma and sarcoma ; the pathological histology of the different neoplasms depends largely upon the vital endowment of individual cells belonging to one tissue series. This vital endowment, as we have already observed when speaking of the ætiology of mammary tumors, may extend backward to the embryonic period, or be acquired, as a degeneration of physiological forms.

Myxomata of the breast have their seat in the connective-tissue that surrounds the secreting apparatus of the gland, and as the neoplasm grows, show a disposition to crowd upon the caliber of the lactiferous ducts, not uniformely, but in the shape of "papillary prolongation. The entire tumor is at times composed of these mucoid prolongations, the whole constituting a mass connected by the mucoid degeneration of the connective-tissue stroma of the gland. When the lactiferous ducts are not entirely occupied by the myxomatous tissue, cysts remain that contain a substance more fluid than that forming the neoplasm, *cystoid myxoma.*

Generally myxomata are not rich in vessels, but the vascular development may be excessive, and if the walls of the vessels rupture, and this they are likely to do for they are very delicate, profuse hemorrhage results ; or the cyst becomes filled with blood, which upon pressure exudes from the nipple, *telangiectatic myxoma.*

Lypomatous myxoma, when such a neoplasm exists independently of a fatty tumor that has taken on mucoid degeneration, arises either as a fatty infiltration of the nucleated mucous cells, or, and this I consider the most frequent origin, mucous tissue from the fœtal period that should pass on into fatty tissue persists, and there is formed a mucoid neoplasm, containing fat and free fat cells, having a matrix of fat tissues.

Reference to what has already been said concerning the

fat bodies, and their relation to the mammary gland, will be found to favor this view. During the period when the gland is developing, any lingering embryonic tissue would be very likely to remain quiescent, or possibly this very process, the replacement of the fat bodies by the mammary gland, may serve to call into force all the evolutionary power of the fat cells, and only after the change has taken place can it be said that the embryonic tissue persists. When the gland is folding up, and its cells cease to perform their function; when the sources of nourishment are changed, errors of nutrition in individual cell groups are frequent, and at that time any abnormal cell focus that receives its peculiar pabulum, receives with it an impulse to grow. We find that it is just this period in the life of the lacteal gland, between the fortieth and fiftieth years, that myxomata of the breast are the most frequent.

Myxoma of the breast is usually developed as a single tumor. Round, sometimes lobulated tumors, their unequal exterior is caused by the disposition they show to reach the surface of the chest, in the direction of the least resistance. They may attain an enormous size, in some instances involving the entire mamma, but this is unusual. They are soft, and present a distinct fluctuation, that is likely to lead to a mistake in diagnosis, and render aspiration of the tumor necessary to establish this clearly.

I would here enter a plea in favor of using the aspirator to reach a diagnosis of any doubtful tumor. I have never known an unfavorable symptom to follow its use, and in many cases I have been able with it to clear obscure questions, and to relieve the patient's anxiety—not a small or unimportant matter—and at the same time indicate the course of treatment, for or against an operation.

Myxomata are liable to inflame and ulcerate superficially. This breaking down of the integument is frequently followed by the protrusion of a bleeding fungus, from which there exudes a sanious fetid discharge. This degeneration does not attack the mucous tissue, but is the result of injury to the integument, or of pressure; when the opposition to the growth of the mucous tissue, that is exerted by the

tegumentary covering is removed, the neoplasm springs through the opening and grows rapidly.

Myxomata increase rapidly, especially will this be true of those tumors that have their origin in an œdematous degeneration of connective tissue cells; the capacity of mucous for absorption has already been mentioned, and will explain the rapid enlargement of mucous neoplasms. They do not involve the deeper structures, and there is only a feeble tendency to the development of visceral mucoid growths. The axillary glands rarely enlarge. In the cases recorded, the period at which this occurred is not mentioned. With the known benign character of myxoma, lymphatic swelling does not of necessity indicate secondary neoplasms, but may, if appearing when the mammary tumor has ulcerated, be entirely due to the absorption of inflammatory products, that can not pass through the gland; or there is the possibility that the specific cells are deposited in the lymphatic glands, and form a focus for a new growth. The nipple and superficial veins are not implicated. Even when ulceration takes place, the surrounding integument remains healthy.

When thoroughly excised, myxomata of the mammæ do not return; the rational treatment therefore, when the diagnosis is certain, will be an operation that has for its object the removal of the entire neoplasm.

h. Chondroma.—Among the first to recognize cartilaginous tumors microscopically was Johannes Müller, and since the publication of his great work on cancer, our knowledge of this neoplasm has increased.

Chondroma consists of a tissue that resembles fœtal cartilage, both varieties of which, the hyaline having a homogeneous matrix, and the fibro-cartilage having a fibrous matrix, are represented, though more frequently the former. The tumor is made up either of one mass or of many nodules. This lobulation is quite peculiar to chondroma, and to be distinguished from a similar appearance in lipoma. The lobules are developed from independent cell centers, and have no closer relations than arise from con-

tiguity of surface; sometimes the lobules are separated by a layer of areolar tissue.

These two methods of development present corresponding clinical features; in one instance the surface of the tumor is uniform, in the other its surface is uneven from the depressions that exist between the lo ules.

Chondroma vary greatly in consistency, and not only do individual tumors differ in this respect, but in one tumor may be found almost every variety of normal cartilage, from hard fibrous structure, to soft, almost mucoid tissue; the cartilage is also generally found in combination with other tissues, principally connective or fatty tissue, less frequently osseous tissue.

Cartilaginous tumors are supplied with blood by means of the vessels that exist in the connective tissue that binds the lobules together; for being a non-vascular tissue, cartilage is nourished by the passage of nutrition from cell to cell. In this respect a marked microscopical difference exists between normal cartilage and a neoplastic growth. The former, not being traversed by connective tissue partitions, is not seen to be penetrated in all directions with vascular canals. This peripheral nourishment is limited by the size of the growth, it being impossible for the cells to convey the blood beyond a certain distance from the blood vessels. Hence when a chondroma has attained a size that can not longer be nourished in this manner, it must cease to grow, or die, or as probably sometimes occurs, repeating the physiological formation of the osseous system from cartilage, a canal forms in the center of the tumor—in the skeleton in the cartilaginous epiphyses—and through the blood vessels that this contains the inner parts of the tumor are supplied with blood.

If the tumor is divided into many lobes, and such are generally the smaller chondromata, the connective tissue is more abundant, and consequently the neoplasm may be very vascular; this condition generally precedes ossification, or teleangiectatic degeneration.

Though cartilaginous tumors bear a striking likeness to fœtal cartilage, the arrangement of their microscopic con-

stituents is in some particulars quite unlike that of hyaline tissues. These dissimilarities consist chiefly in the number, size and shape of the cells and nuclei, and are not infrequently found in different parts of the same tumor. This anatomical structure has no parallel in innocent neoplasms, and seems to be the only exception to the pathological law enunciated by Bruch, that diversity of microscopic elements was a characteristic of cancerous (carcinomatous) tumors.

Section of a chondroma shows a neoplasm of a bluish white color, translucent or opaque, as the slice is thin or thick. Under the microscope this is seen to be composed of a solid mass,—the matrix,—through which, or rather in cavities of which, are variously shaped cartilage cells, sometimes arranged singly, sometimes in groups, an evidence, as has been observed by Rindfleisch, that enlargement takes place from an interior growth. The peripheral cartilage cells are gradually transformed into fibrous cartilage, that, together with the connective tissue capsule, when one exists, constitutes an obstacle in the way of infiltration of secondary tissues, and somewhat resembles the normal perichondrium. The matrix usually contains interlacing fibers, the excessive development of which has the effect of rendering the tumor firm, and more nearly to approach the character of fibroma.

The causes of chondromata of the mammary gland, in which organ they are extremely rare, are probably not different from the conditions that induce cartilaginous tumors in other situations,—a low degree of inflammation. In this regard they seem to bear a striking resemblance to sarcoma, and myxoma, and to give rise to the possible conception that all neoplasms constructed upon an embryonic tissue type, are physiologically represented by the development and growth of inflammatory new formations.

Chondromata are usually single, though they may be multiple, or in the breast as in other glands, may appear as a piece of cartilage without the organization that in general belongs to neoplasms. Chondromata belong to the period of youth. When situated in the breast, to what

degree they are connected with the evolution of the lacteal gland can not be determined, but it is probable that oft-repeated spurious unfolding carried beyond the physiological limit, is at times an ætiological factor.

Chondroma belongs to the class of innocent neoplasms, though metastases have been met with,—but the primary tumor, as long as it preserves a cartilaginous type, does not, save possibly from its size, or the destruction of function that its growth involves, interfere with health.

The degenerations to which chondromata are subject have their origin principally in softening of the matrix-substance of the neoplasm, for aside from calcification and true ossification of chrondromata, both of which changes are rather in the direction of physiological metamorphosis of the cartilage cells, and may attack either the basis substance, or cells and capsule, the cartilage cells are changed secondarily by a primary mucoid degeneration of the matrix, by which eventually the entire central part of the tumor becomes liquidized. These changes lead to the formation of a single giant cyst, or when the scattered points in which liquifaction began remain distinct, to several smaller cysts.

Treatment.—I am not aware that chondroma has ever yielded to more conservative treatment than excision, which has rarely been known to be followed by a return of the disease ; the remedies most likely to act upon cartilaginous tumors, are *baryta carb.*, *calcarea carb.*, *graphites*, *hepar sulph.*, *ledium*, *sepia*, *silicea*, *sulphur.*

i. Osteoma. The development of osteoma resembles the normal development of bone in this, both may arise either from osteoblasts or from metaplasia of existing tissue. In general, osteoblasts, have their origin in granulation tissue, and hence mammary osteomata that are developed from osteoblasts, must arise either from the periosteum of the ribs—an origin not sustained by the history of the few cases of osseous tumors of the breast that have been observed—or from an inflammatory new formation, which in this

instance involves a lesion that requires a repair of structure.

The process of metaplasia is the most frequent etiological factor in the development of mammary osteomata, for it is as infiltrations of previously existing neoplasms that they have been observed; the propriety, therefore, of considering mammary osteomata as neoplasms *sui generis*, may be questioned, but this division seems to be justified if we adopt histology as the basis of the nomenclature of tumors, the preponderating element serving to name the neoplasm; and also if we have regard to the developmental phase that osseous tissue holds in relation to the formations of tissue. For osseous tissue is what has been called by Rindfleisch a terminal tissue; it stands at the end of a series of metamorphoses, and is sufficiently characteristic to distinguish itself from any other growths, and give a name to the entire mass when it occurs in any quantity; especially so, as because of this metaplasia the primary cells are no longer recognizable, nor can their origin be traced save by the histology of the remaining unchanged tissue.

Osseous tumors of the breast, like enchondromata, are rare; they probably originate in cartilaginous tumors by ossifications of the cartilage cells, or in a calcification of the walls of the lacteal ducts, and subsequent partial closure of the canal; a process similar to that which obtains in the calcification of arteries. They also sometimes arise in the walls of old abscesses, and in chronic mastitis, but these deposits of lime are in the form of plates and concretions, that are adventitious to the primary pathology of the part.

The causes of calcareous hyperplasia are not always clear. If we adopt a chemical hypothesis, we find that free carbonic acid is the principal solvent of the salts of the phosphate and carbonate of lime, and hence when there is a deficiency of this acid, at least one condition favorable to the deposit of the lime salts is present—their abnormal accumulation in the blood. The apt locality for their precipitation, after the blood has reached its point of saturation, seems in some instances to be determined by slowness or stagnation of the circulation, phenomena that occupy

constant relations to the inflammatory process. This is shown in the ossification of enchondroma, which always takes place in those parts furthest removed from the periphery, where, as we have seen, the circulation is the most active.

Osseous tumors are but imperfect imitations of bone tissue; they are the basis substance or cells, replaced by the salts found in bone, but the mass so formed has not the systems of canaliculi and lacunæ, that enter into the construction of bone.

Osteoma of the breast has been found in two forms; either as hard, round, or oval masses, generally irregular, or as plates and septa of calcareous deposits, or as osteo-calcareous needles that traverse the gland in different directions. Instances of such a formation have been mentioned by M. Velpeau; they probably originate in calcification of the walls of the lacteal ducts, or possibly in an infiltration of the fibrous stroma of the gland. Bonnet, Wolf, and others, quote instances of the ossification of the entire breast, and A. Bérard reports the case of a man whose chest beneath the integuments was completely ossified. This case, as M. Velpeau remarked, was probably an example of *cancer en cuirasse*, or more probable still, as there seems to have been no history of malignancy, of a diffuse fibroma of the breast. Such forms are, however, exceptional, and have not been well attested. When a chondroma ossifies, it is usually from several points of ossification, scattered irregularly through the tumor, or the tumor may be surrounded by a shell of bone.

Osseous tumors belong to the later periods of life, and their growth is usually very slow. A case of osteoma came under the observation of Sir Astley Cooper, that had existed for fourteen years; and Morgagni reports a case that had been under observation for thirty years, without taking on any acute changes. They are usually accompanied with considerable pain, and their size may occasion much inconvenience; further than this they produce no marked alteration of the general health.

Treatment.—Amputation of the breast, or enucleation

of the tumor when small, is generally the best and only means of treatment at the command of the surgeon. But in osteomata because of their slow growth, and indisposition to a fatal termination, perhaps more frequently than any other neoplasm of the breast, will be found an opportunity for medical treatment, before an operation is resorted to. The following medicines will be studied with advantage: *asafœtida*, *aurum*, *baryta*, *calcarea carb.*, *cina*, *dulcamara*, *graphites*, *hepar s.*, *lachesis*, *mezerium*, *mercurius*, *nitric acid*, *phosphorus*, *rhus tox.*, *ruta grav.*, *silicea*, *staphysagria*, *sulphur*.

C. Neoplasms derived from Epithelial Tissue.—Epiblastic Tumors.

These neoplasms are modeled upon the simple glandular type. They are made up of epithelial cells held in vascular connective tissue, and this construction is rarely so altered even in the advanced stages of the growth, as to pass beyond recognition.

The degree of truthfulness with which epithelial neoplasms reproduce a particular glandular type, divides them into two groups,—*Adenomata*, constructed after the type of secreting glands, composed of tubules and alveoli lined with epithelial cells situated upon a basement membrane, the whole held together by connective tissues; and *Carcinomata*, constructed after the type of the first stages of gland evolution. The tumors belonging to this group retain their imperfect structure, and do not advance beyond a mass of connective tissue, containing an irregular distribution of epithelial cell clusters.

Epithelial neoplasms represent malignancy in its most marked degree, and in their history are associated with the functional activity of the matrix out of which, and in which they are developed. In this fact possibly exists a principal cause of their virulence, which does not arise alone from the development of secondary tumors, and metastasis, but also and I think chiefly, from the demand they make upon the system for nourishment; for it will be remembered

that the series of tissue formations that epithelial neoplasms imitate, perform an office that draws largely upon the general nutritive supply. The gland, however, eliminates and reconstructs, and so makes use of its pabulum and proliferating cells, but the neoplasm, having no function to perform, and still being constructed after the type of a tissue that requires excessive nourishment, is occupied with the hypernutrition and multiplication of cells that are not cast off, but remain in the system as parasites, together with those already existing, or manufactured elements, that the gland would remove.

In considering epithelial neoplasms of the mammary gland, we have to deal especially with tumors of epiblastic origin, for the epithelium of the lacteal ducts is derived from the outermost of the three blastodermic layers, and it is by multiplication of these simple secreting cells that this class of tumors develops.

α. Adenoma.

This neoplasm of the breast has received various names. Sir Astley Cooper, who first called especial attention to the disease, named it the *chronic mammary tumor*. The term suggests a continuous inflammatory action, and may convey an erroneous impression of the nature of the growth. M. Velpeau claims to have proposed the name *adenoid tumor* or *adenoma*, a pretension not well sustained. Mr. Abernethy designated the disease *pancreatic sarcoma*, but he applied sarcoma to a variety of tumors, and it seems probable, as Mr. Paget has remarked, that the mammary tumor of Mr. Abernethy was a medullary *cancerous*, (carcinomatous) disease. Mr. Lebert has named the growth *imperfect hypertrophy* of the mammary gland ; and Mr. Birkett has called it *lobular imperfect grandular hypertrophy*.

A tumor formed of true glandular tissue developed within the gland, is probably one of the least frequently encountered neoplasms of the breast. The older surgeons confounded with adenoma of the mammæ, fibroid tumors and some sarcomas, but with additional facilities for diagnosis, it has been possible to distinguish between these several growths,

and for this reason, the term adenoma is to be used in a more limited sense than formerly.

When studying the histogeny of general hypertrophy of the mammary gland, we found that the pathology consisted in an excessive uniform growth of gland structure, the only abnormal feature of which was the size to which it attained. In adenoma there is represented a similar process, but the abnormal development is limited to a small portion of the gland, one of its lobes. With the increase in size of the mammæ, there is rarely an increase in function, the cells, while they can be demonstrated to be descendants of the true gland cells, have not inherited the lacteal function. A difference of arrangement of the cells has also been observed. They are piled above each other, and show little disposition to regular arrangement around the lacteal tubes. It has been observed by Rindfleisch, that "a regular fatty metamorphosis remains absent," a fact corroborative of the imperfect physiological action of these abnormally developed gland cells.

When examined with the microscope, an adenoma is found to be made up of lobes and acini. These may be placed very near to each other, but more frequently there are "partitions of filamentous looking tissue, fasciculi of which, curving and variously combined, appear to arch over, and to bound each acinus and lobule." In some cases the similarity between the tumor and the lobe in which it is situated, to which similarity M. Lebert has called attention, is quite remarkable, but more generally the growth resembles an undeveloped mammary gland, examples of which exist in young girls before the age of puberty, and in the male breast. The tumor is more frequently constructed upon the type of some other gland, than that of the one in which it is developed, showing that the growth is not an hypertrophy but a true neoplasm. The neoplasm is surrounded by a dense fibro-cellular envelope continuous with the stroma of the gland, and in some instances the membrana propria increased to accommodate itself to the enlarged glandular structure. Sir B. Brodie observed, that in some cases the glandular structure was mingled

with adipose tissue as in the healthy breast, but it is not probable that the presence of fat in adenoma, indicates fatty metamorphose of the glandular epithelium ; this metamorphosis if it takes place at all, does so to a limited extent only, and when fat is found associated with adenoma, it points to a genesis of the hyperplasia closely resembling the normal process.

When cut into, the tumors are found to vary in color, from grayish-red to a dark red, depending in a great measure on the quantity of blood that they contain and the length of time they have been exposed to the atmosphere, for oxygen turns the tissues a dark smoky color. Whatever the color may be, it is quite distinct from the color of the matrix, and will sometimes serve as a valuable diagnostic sign. In consistency the tumors vary from a dense, almost fibrous hardness, to a soft compressible growth, according to the proportion of glandular and fibrous tissue admixture. They contain a varying quantity of mucous juices, frequently yellowish, that can be pressed from the softer growths, in which they are most abundant.

The ætiology of adenoma of the mammæ is closely related to the functional activity of the reproductive organs, and to lactation ; more closely than any other neoplasm of the breast. So true is this, that it may be questioned whether adenoma of this gland ever arises from any other cause than some degree of physiological activity,—the evolution and involution naturally attendant upon lactation and ovulation. If the action is physiological, that is, if the initial stimulant is the gravid uterus, we have more especially to watch the upfolding of the gland. When this is not perfectly performed, gland cells remain in abundance within the acini, and after in other respects the upfolding of the gland has become complete, multiply rapidly and form the nucleus for a future glandular neoplasm. It is probable that every menstruation, at which time the breasts sympathize with the reproductive organs to a greater or less degree, repeats the phenomena that we have recognized as the initial steps in the development of glandular tumors, and that when once started, the crowding

of epithelial cells that takes place within the alveolus as the result of a proliferation of cells "close at the limits of the connective tissue,"—the limiting membrane of that particular part of the gland,—is not spontaneously arrested until the period of life at which reproductive activity ceases.

Agreeable with this, the history of mammary adenoma, shows that it belongs to the child-bearing period, and to be more frequent in women who have borne children, but let it be noted, not necessarily in those who have suckled their offspring. Lactation when normally performed, may be regarded as a prophylactic against mammary adenoma, and possibly a natural cure for the beginning neoplasm, but both this question and that one which concerns the disappearance of the tumor after ovulation has finally ceased, are difficult of solution, from the fact of the excessive liability that these neoplasms show to cystoid degenerations, and also from the absence of trustworthy statistics bearing upon this subject.

The irregularity with which menstrual difficulties are associated with the development of mammary adenoma, excludes them from the recognized causes of this neoplasm of the breast. Possibly in some instances dysmenorrhœa may be one of the exciting causes of adenoma, but it is probable that such cases are limited to those where dysmenorrhœa is ovarian, rather than uterine. Unhealthy ovulation gives rise to a low grade of mammary evolution, and as we have seen when speaking of the ætiology of the mammary gland, this spurious excitation represents imperfectly, physiological unfolding, and is attended by the cellular metamorphoses—in its lowest state large pigment cells—of the first stages of lactation. The histology is concerned with the epithelial structure of the gland, and in the second stage is represented by the large granular cells, which through the process of vacuolation, more nearly approach the lacteal secretion. But the false excitation is not of a nature to carry the evolution of the gland beyond the development of granular cells; the complete mammary unfolding is never reached. These cells therefore have no

definite purpose and no function, and become waste cells, but the lymphatics not being sufficiently excited to carry them away, they remain as a tumor forming nucleus. Mr. Creighton has suggested that the tumors to which the breast is subject, represent the functional force of lactation arrested at one of the degrees through which it would pass to perfect functional activity. The theory seems to accord with the clinical history of mammary tumors, and it is possible that when mammary evolution, functional activity, involution and the period of rest are better understood, and the morphology of mammary tumors more carefully studied, the nomenclature of tumors of the breast will have reference to the physiological phases through which the stimulated gland passes. The tumors we are studying, when the stimulus is a spurious excitation, may be considered as having their origin in that period of evolution in which epithelial cells multiply rapidly, but do not proceed to the lacteal vacuolation process. The cells crowd in successive layers upon the lumen of the acini, but here the unfolding stops, and the mass of cells is left to occupy a part of the gland. The steps by which this nucleus enlarges and causes distention of the limiting membrane, the methods by which a cavity remains in the acinus afterward to become filled with a substance of varying consistence, or how giant cells in isolated parts of what has become a tumor, vacuolate and form cysts, follow naturally from what we have learned of the morphology of these growths.

But not all adenomata are formed in the secreting part of the gland ; they may also arise from epithelial cells that have wandered into the connective tissue. When developed from such bodies, the neoplasm has no connection with the ducts of the gland, and derives its capsule from the connective tissue stroma in which it rest.

For the same reason that sexual irritation will cause development of all the reproductive organs, and this we have noted to be true in some cases of general glandular hypertrophy, this may be considered as a remote factor in the ætiology of adenoma. Mr. Cooke states that in some instances he has been able to connect their appearance with

sexual irritation, brought about by too frequent coition or masturbation. He has also adduced evidence that goes far toward proving that glandular tumors of the breast and phthisis pulmonalis, are connected in no indirect manner. It may, however, be questioned whether the tumors that Mr. Cooke refers to are true examples of adenoma; they more probably partake of the nature of an infiltration—which characteristic would ally them to the carcinomatous group—and possess no definite boundary, as do the true adenoid tumors.

First observed as a small hard tumor seated in almost any division of the gland, though most commonly at its upper and inner part, an adenoma is rarely attended with more suffering than an occasional uneasiness and sometimes sensitiveness at the menstrual period. When there is any considerable suffering, it may generally be attributed to the nervous apprehension that arises from the presence of a tumor in the breast, an organ prone to the development of the most malignant neoplasms.

The mammary adenoid tumor is almost always single, a fact that has not hitherto received a satisfactory explanation, for arising as it does in one of the many acini of the gland, or from one of numerous centers of cell infiltration into the connective tissue stroma, the selection of the pathological center would seem to depend upon a local condition that antedates the degree of functional activity in which the initial cellular changes had their origin; but of the nature of these, if multiple, predisposing causes, we are not in possession of sufficient data to place them in the rank of positive knowledge. When multiple in the breast, the tumors appear as successive growths, and probably mark a recurrence of those causes that were potent to develop the primary neoplasm.

The growth may be superficial or deep, but in neither case is it so closely attached to the surrounding structures as to interfere with free motion. In the younger and smaller tumors careful manipulation will sometimes succeed in discovering a direction in which the motion of the tumor is slightly limited, where upon burying the fingers of

both hands conjointly beneath the surface of the growth, a cord-like attachment will be found ; this is as a pedicle to the tumor, and is probably the remains of the duct that led from the particular acinus in which the adenoma developed. The surface of an adenoma is uneven, and nodular, and its shape ovoid ; the consistence hard and unyielding, excepting when it has suffered cystic degeneration, then the resistance will correspond to the degree to which the cystic development has taken place.

Mammary adenoma rarely attains a larger size than that of a hen's egg. One of the largest recorded was removed by Mr. Stanley. (Mus. Coll. Surg. London, No. 208). It measured twelve inches in length, and weighed seven pounds. The breast was pendulous and rested upon the woman's knees when she sat. Mr. Liston (*Op. cit.* No. 216) removed a tumor of the same nature, that weighed twelve pounds.

Their growth is at first generally slow, and after attaining the size of a walnut, may remain stationary for a length of time, or entirely disappear with the restoration of any ovarian irritation that may have preceded their development. But usually after a varying period of inactivity, the tumor, without appreciable cause, begins to grow, and in one year may increase more rapidly than during all the years of its previous existence, though compared with other tumors, adenomata are always of slow growth.

There is a peculiarity observed in the method of growth when this process takes place rapidly, that does not belong to any other neoplasm not depending upon infiltration for support. Up to a certain period, and this period is limited by the time when the tumor ceases to grow after the impulse to development has been received, the growth seems to proceed from within the membrana propria of the lobule effected, and may be referred to multiplication and enlargement of glandular epithelium ; but when what would seem to be the limits of the distensibility of this membrane have been reached, this method of growth ceases, and after this check to the increase in size of this particular lobule, the pathological error spreads to contiguous parts, and the tumor

grows by the addition of new nodules to the primary growth. Thus in the older and larger tumors the nodulated surface does not always depend upon intra-cystic development, but upon the implication of hitherto healthy lobules of the gland.

In this method of enlarging is there not to be found an explanation of the arrest of growth that constitutes one of the features in the early history of adenoma? The limiting membrane, and the temporary withdrawal of the primary cause of perverted cell genesis, induce a pause in growth, but the membrane having regained its elasticity, and cell activity returning, the neoplasm begins again to grow. It is evident, however, that the capsule must soon reach the limit of its distensibility, and hence the subsequent increase in size of the mammary adenoma must be from the aggregation of secondary neoplasms.

No tumors are less liable to degenerations that prove incompatible with health than adenoma of the mammary gland, and still the morphology of the neoplasm, involving as it does the history of erratic epithelial proliferation and arrangement, is in the direction of the widest departure from the normal development of glands.

Against the carcinomatous degeneration of adenomata, it has been urged (Sir James Paget) that carcinoma and adenoma may exist together in one breast. But this does not prove the position. A person having a tendency to carcinoma, may also have a mammary adenoma; and while *à priori* it is considered that such a neoplasm would be the seat of any predisposition to an abnormal histogenesis, and generally would, conditions may exist elsewhere in the same gland that are more favorable to the carcinomatous epithelial proliferation. In this very fact lies an ætiological distinction between adenoma and carcinoma: they are different expressions of the same pathological morphology. And while it is not possible to prove that a neoplasm constructed upon the type of a secreting gland, ever degenerates into an epithelial neoplasm without definite glandular structure, there is apparently no reason why this should not be, as well as that both varieties of epiblastic tumors should exist simultaneously in the same gland.

The conditions necessary for the development of a homologous into a heterogeneous neoplasm, are neither known, nor their nature understood, but a physiological type exists for every pathological formation, and an adenoma may be considered as near the beginning of those changes that in later stages are recognized as bearing the least likeness to normal cell life. The truth is, that we are not justified in regarding as of no clinical significance, even the slightest deviation from what we have learned to look upon as an expression of normal formative power, provided that deviation is at variance with the general law of development and growth, that each unit and part of the organism shall conduce toward the highest evolution of which that organism is capable. The fact that there is a center of growth, which in no way contributes to the general well being of the organism, is sufficient ground for believing that under the influence of local hypernutrition, or a latent diathesis, further degenerations may take place.

It is beyond positive knowledge to consider the slight deviation in the formation process which results in the outgrowth of a part, as but one expression of a diathesis, that in its extreme development exhibits a carcinomatous growth ; but this is known, that from the undifferentiated blastoderm, is developed all the complicated parts of which the mature organism is made up, and that the order of life is from the simple to the complex, from the homogeneous to the heterogeneous, that each cell, before it reaches maturity, repeats within itself, the changes through which the embryo passes, toward the perfect animal.

On the other hand, the laws of reversion,—atavism,—are equally well marked. A cell retains its primitive form, and from that degenerates into one that draws upon the entire organism for support. Now the same laws of nourishment obtain in pathology that are known to be universal in physiology, and hence we may conclude, that, for example, the most degenerated neoplasms belonging to the glandular epithelial series have had their origin in normal epithelium, and by successive stages have reached the low form that marks their malignancy. After removing an ade-

noma of the breast, a carcinoma has been known to occupy, in a short time, the site of the primary growth. This rare occurrence supports the above position, that malignant growths may have their origin in simple neoplasms, or that the irritation consequent upon the removal of the adenoma, is favorable for the degeneration of tissue that ends in a carcinoma.

Adenoma seems to be hereditary only in a general sense ; that is to say, although parents who suffer from glandular tumors are not likely to transmit their disease, at least in the same form to their offspring, some members of a family in which carcinoma is known to have developed, are affected with tumors that resemble glandular growths in structure, but run a rapid course and present the forbidding aspect characteristic of malignant tumors. If there is, as has been asserted, (Henry F. Butlin) a relation between certain parasites found in malignant tumors, and the development of those neoplasms ; if we are to believe that there is an infectious fluid "or seminum" (Simon) which is the active agent in the return of malignant growths and their secondary deposits, may we not also look upon such a gradation in the force of malignancy as shows itself less and less virulent with each successive generation, as belonging to much the same class of phenomena that M. Pasteur has demonstrated in connection with the successive culture of the anthrax and the hydrophobia virus. To the investigator, any novelty offers a fascinating field for study, but the tendency is to attach undue importance to the unknown, and to place a boundary to the sphere of newly discovered phenomena, which more accurate knowledge contracts. So we find, that at the present day the germ theory of disease is made to cover a wide field of pathology, but it is possible that the history of some neoplasms will be found to be associated with the genesis of these minute organisms.

The skin covering adenoid tumors, even when subjected to great tension, does not usually ulcerate, or show any sign of degeneration. The reverse of this is however sometimes true. The subcutaneous veins become prominent, the skin discolored, and from the nipple, which is retracted,

there exudes a bloody discharge. Ulceration may finally take place with fungoid bleeding granulations, and with this there is usually some enlargement of the axillary glands. But an analysis of these rare complications will rob them of the gravity that at first sight there would seem to be attached to their presence. The tegumentary discoloration is mechanical, and may occur with any large superficial neoplasm. The retraction of the nipple may not be so much a drawing in of that body as an enlargement of the parts that surround the nipple; and the discharge from the mammilla may have no other significance than the presence of cysts within the growth. The enlargement of the axillary glands is rather a true adenitis from irritation, than a repetition of the mammary hyperplasia.

The history of adenomata of the mammary gland, shows them to be cystic in the majority of cases. The cysts may contain various fluid or semi-fluid substances, the result of changes in the epithelium lining the wall of the cyst. It is questionable whether the cysts of adenoid tumors should be regarded as degenerative changes in the typical growth. So frequently are they found in connection with adenoma, and so closely are they related to the process of cell vacuolation, and the natural tendency of gland tissue to form cavities and tubules, and further, so early in the growth of the tumor are cysts found, that at least in some cases there seems reason to justify the belief that the cystic adenoma is the typical growth, and not developed by any process of degeneration. In the older adenoid tumors, the original form of the neoplasm is sometimes obscured by intra-cystic growths. These, when ulceration has taken place in the cyst wall, protrude in the form of vegetations, and fill the entire cyst cavity with an epithelial growth.

The true degenerative changes that take place in adenomata of the breast are probably limited to the telangiectatic and the myxomatous; the point of pathological departure in both being in the intraacinous growth, hence it is epithelial in origin.

Treatment.—There is but one successful method of treat-

ing adenoma,—excision. For while it may truly be said that the growth will not prove incompatible with health, conformable to the pathology that has thus far been maintained, the assertion can not be made that even the most simple departure from physiological histology may not form the starting point for the widest errors of nutrition, and most perverted cell development. In adenoma, local absorbents or internal medication are worse than useless; they are the means of losing valuable time, and if they produce any effect, certainly in the case of the local measures, it is that of injury of the integument covering the tumor. But in the early stages of this neoplasm, when the proliferation of the epithelial structure begins, medication may avail to arrest the growth. It is unquestionably true that what to all appearances were examples of adenoma, have been known to undergo such spontaneous changes as resulted in their absorption at the climacteric, after marriage, especially if followed by pregnancy and lactation, and also after an attack of local erysipelas. The first cause acting through fatty metamorphose of the accumulated epithelial cells; the second, by the substitution of true hypertrophy; and the third, through the action of the deep lymphatics; but such cases are always open to the question of an error in diagnosis, it being impossible in them to apply the crucial test furnished by the microscope. In consideration, however, of even the remote possibility of a spontaneous cure; and if child-bearing, or the climacteric can enter as probable factors into the prognosis of the case, it is prudent to withhold active interference, but when there are indications of active growth of the tumor, or signs of degeneration taking place, excision should be performed without delay. If neither child-bearing nor the climacteric are likely to exert a favorable influence in the history of the tumor, the operation, provided always that the diagnosis is correct, need not be longer delayed.

In no disease of the breast may more favorable results be expected from operative interference than in adenoma. The superficial situation of the tumor, the healthy condition of the surrounding tissues, render the removal of the

growth easy, and a speedy cure almost certain. It is not necessary, or possible in many cases to remove the fibrous capsule, the wound will granulate from the bottom and prevent any further growth in that particular lobule of the gland. The dressing of the wound should be strictly antiseptic, and applied in such a manner as to exert pressure on the site of the excised tumor, always observing the rule that dry, infrequent dressings, with compression, are preferable to all others, when they can be used.

The cavity left by the removed growth may be washed out with a 1-1000 solution of the bi-chloride of mercury, but recently I have had reason to doubt the advisability of this practice. The principal point to be remembered in this stage of the dressing, is to stop all bleeding and oozing from the vessels, and remove all clots before closing the wound. The incision is closed with many small wire sutures, leaving at its most dependent angle an opening for a perforated rubber drainage tube. Over the incision I smear the compound tincture of benzoin, or dust boracic acid, and complete the dressing with absorbent cotton, and a light roller bandage.

On the projecting end of the drainage tube, which should be long enough to allow an entirely separate dressing, I secure a pad of marine lint. This latter is used simply as a precaution against possible suppuration, but I have yet to see the case of excision of simple adenoma, without a complicating diathesis, that has not healed by first intention, when treated after this method.

b. Carcinomatous—epithelioma.—In the more exact pathology of the present day, which seeks in physiological processes the matrix of morbid processes, and bases the classification of neoplasms in a wide sense upon embryonic differentiation, in a narrower sense upon minute anatomy, the term cancer can no longer occupy a place. Cancer describes an appearance that neither belongs to a single class of neoplasms nor is associated with a special clinical history ; but has from early times been used as synonymous with malignancy in tumors. Now we have seen that a variety of tumors must be regarded as malignant ; some in a less,

some in a greater degree; tumors that have little in common, not enough to be classed together under even such a comprehensive term as cancer.

Carcinomatous epithelioma of the mammary gland is an accidental organ, constructed of epithelial cells irregularly arranged in nests, chains and processes, within the connective-tissue stroma of the breast. The epithelial cells and their disposition must be considered the essential characteristics of carcinoma, and the connective tissue which forms an uncertain boundary to their growth as accessory to this feature. Whatever secondary changes or degenerations may take place in the neoplasm, this anatomy will remain the distinguishing character of carcinoma.

There is absolutely nothing specific about the cells of carcinoma; nothing when examined separately and if isolated from their surroundings that would serve to distinguish them from other epithelial cells that have multiplied rapidly and been subjected to pressure. Histologically they represent epithelial cells that possess an activity of reproduction in excess of their developmental power; the glandular epithelium has lost its functional power, and henceforth its energies are given to the multiplication of ill shaped, imperfectly formed bodies.

The nidus of epithelial proliferation, which early in the growth of the tumor becomes multiple, is situated in the secreting apparatus; and as it grows, pushes out processes that infringe upon the connective-tissue stroma and finally destroy it by pressure and irritative inflammation; the pathological cells also at the same time wander from their birth-place and infiltrate the surrounding connective tissue; they are also taken up by the lymphatic glands, to which they gain access by passing into the lymph spaces of the connective-tissue, and thence into the lymphatic vessels.

The ætiology of mammary carcinoma is, as we have found to be with adenoma, in a peculiarly intimate manner related to the evolution and involution of the lacteal function. In both, the epithelial cells perform the principal office, and in both, the multiplication of cells occupies a chief part. The analogy however, ceases here, for at this

point one process passes on to the production of a pathological new-formation, and the other to the performance of a physiological function.

The production of milk is accomplished by an endogenous cell formation of the glandular epithelial cells. The irritation necessary for this proliferation is impressed upon the cells by the reproductive organs, principally the ovaries and Fallopian tubes, possibly in some instances the uterus also. We have already referred at length to the evolution and involution of the mammary gland ; epithelial neoplasms are especially related to the spurious functional activity, and to the final up-folding of the function.

The undifferentiated blastodermic layers contain the possibility under proper nourishment, of developing the kind of force and the degree of force that are essential to the evolution of the entire organism.

That which is applicable to the whole is also applicable to each individual organic unit, to each cell. For the development of a typical epithelial cell from existing epithelial-cells, or from embryonic bodies, a certain kind and degree of stimulus is required ; if these are wanting, or if they are applied in excess, errors in histogenesis must result. Applying this principle to the function of the mammary gland we find that when the "functional stimulus is acting at its lowest point the secretory product is a large granular pigmented cell ; if the mammary excitation were always to act at that degree of intensity, the secretion, it may be said, would be always in the form of large granular pigmented cells. At the next appreciable advance in the intensity of the stimulus, the product formed in the gland may be described somewhat generally as a large nucleus cell. Beyond the medium degree of intensity, the product is both fluid and cellular, the former being mucus, and the latter, generally speaking, a small round cell. Coming still nearer to the full excitation, the cellular ingredients are fewer, and the mucous production much more abundant." (Creighton).

If at a given time this physiological stimulus is withdrawn, and the cellular products of its activity not removed,

a nidus for the development of a neoplasm that corresponds at first in its cellular features to the stage of excitation, exists. From this physiological beginning, save as the stimulus to evolution is not physiological, there is developed the most irregular epithelial forms, forms in which the proliferating power is greatly in excess of the functional activity. In this mass, which in no sense belongs to the organism, performs no function that contributes to the well-being of the organism, but lives upon it, there is no disposition of its individual units to return to a normal state: they must be removed or continue as a parasite, in the organism.

The waste cells of normal lactation are also important factors in the development of mammary carcinoma, and may serve, under conditions that favor their retention in the extra acinous spaces, as initial points for the pathological proliferation of epithelial cells.

Heredity as a factor in the ætiology of carcinoma occupies a prominent position, but the laws of heredity are among the most complicated in biology, and even at present are not understood. We have, however, only to look at the phenomena of genesis, reproduction, development and growth ; at the history of a species, to realize that heredity is one of the chief laws by which type is preserved, or indeed life maintained. There seems to be no well founded reason for excluding pathological forms from transmissible features. Variations within what we are pleased to call physiology, are obtained intentionally or accidentally, by attending to the laws of breeding and environment, and those variations in the parent are transmitted with reasonable certainty to the offspring. It is not possible to say where physiology ends, and pathology begins, in this question of variation. The lines are so subtle that the excess or decrease in cell function that has broken the equilibrium of health can not be told. The bearing of this upon the inheritance of disease will readily be seen.

All that is transmitted from parent to offspring must pass through the germ cell and the sperm cells in an embry-

onic or undifferentiated form. The reproductive cells are in this sense vehicles (Spencer). The method by which this transmission is accomplished can probably in many instances be referred to the undeveloped gemmules which Mr. Darwin has described in his hypothesis of pangenesis. These gemmules are given off from all tissues, and remain dormant in the organism until called into action by their environment. It is not probable that the actual gemmule forms a part of the reproductive cells, but these being and containing the essence of the organism, transmit the same possibilities of development, that are possessed by the organism of which they are the sum.

Remembering the oneness of pathological and physiological laws, and continuing to apply Virchow's law that the elements of a tumor are derived from pre-existing elements of the organism, we reach the hypothesis that diseased cells also give off gemmules which remain undeveloped for a varying length of time; and also that when those gemmules do become active, when they begin to proliferate, they give rise to a structure similar to their parent cell. It will be seen that we are now standing upon much the same ground with Cohnheim, and his theory of delayed embryonic tissue cells. But it is not sufficient for the development of a neoplasm from latent gemmules that these minute bodies should be present in the tissue; there must be something to arouse them into activity. This something is accidental, either acting from without as trauma, or from within, as the physical changes through which an organism periodically passes, or the decay of vitality incident to age. In this sense only can I find any ground for a belief in the possibility of a neoplasm being inherited—by the application of the physiological laws of heredity. The disease at first is local. The infection of the system follows the local disease as a direct effect of it. There is no contamination of the system; but from the growing and development of cells, the economy ultimately becomes affected.

The at first slight deviations from normal lactation that result in the proliferation by endogenous cell formation of

granular epithelial cells, are conditions that would favor the activity of undeveloped gemmules resident in the mammæ, that had been thrown off from mammary carcinomatous cells in some ancestor. For there is first to be considered the mode of cell proliferation characteristic of lactation —the endogenous—a method that at least predisposes to pathological forms, involving as it does the destruction of the parent cell in giving birth to its progeny. The rapidly proliferated and rapidly proliferating large granular cells, representing the same stage of departure from normal that characterized the parent cells of the undeveloped gemmule, before they were converted into "completely passive or formed material," are calculated by reason of the mutual attraction that must exist between the active and the inactive of the same tissue series, to call the latter into activity and into a state of proliferation.

There is thus from a perfectly physiological function, the diseased gemmules having been transmitted from some ancestor, found a condition capable of developing what then becomes an inherited disease.

But while giving prominence to heredity in the ætiology of carcinoma, the possibility of epithelial cells acquiring great activity of reproduction, with little developmental power, must also be entertained. If we consider the sharply defined boundary between connective-tissue and epithelial tissue, a boundary that begins with the differentiation of the embryonic layers, and is maintained throughout life; maintained moreover by virtue of this very heredity of which we have said much, though much more has been left unsaid, whereby an epithelial cell begets an epithelial cell, and a connective-tissue cell a connective-tissue cell; if, I say, we have regard to these histogenetic laws, we are led to seek in errors in the germinal cells, in a failure on the part of the germ cells, and the sperm cells to establish antecedent equilibrium, the origin of at least some of the changes in cell endowment that so profoundly affect functional activity, and which if allowed to proliferate must ultimately destroy the adaptation of an organ or organism to its environment.

It is well known that mature cells, cells composed of formed material, do not proliferate ; the sources of nourishment of the nucleus, by which the life of the cell is maintained and the cell induced to proliferate, are closed by the more or less dense capsule that envelops them. Neither are formed cells, entering as they do into the construction of the organism, acted upon by external forces. They die, but this involves nothing more than their removal ; they are powerless to multiply or leave progeny that shall continue to represent any abnormal powers that they may possess. To young cells, especially those that may be defined as "a mass of protoplasm inclosing a nucleus" (Cornil and Ranvier), are we to look for the most active proliferation and the most rapid changes. What is true of its component parts is true of the organism as a whole, and while cell deviations may through agencies that affect the sources of nourishment, have their origin in extra-uterine life,—this term is here employed to embrace the entire period after birth—it seems probable that many neoplasms may be traced to cells or gemmules that belong to the unformed and forming periods of life. The fact that carcinoma is a disease of late life, a disease of degeneration, does not conflict with the theory that would place the germs of the neoplasm in the embryonal period of life ; for, as we have already pointed out, a germ or gemmule may remain undeveloped and inactive, receiving only enough nourishment for its support, until the environment, its matrix, furnishes the pabulum and conditions required for its activity. Such conditions exist in the folding up of life in general, and especially in the folding up of the lacteal function. In this sense, carcinoma is not a degenerative neoplasm, but a variety of cell proliferation that requires physical decay for its stimulus.

It has been suggested by Mr. Haviland, that certain climatic conditions and the appearance of "cancer" are related with sufficient frequency to turn investigation in the direction of discovering the actual relation that exists between the natural and the physical phenomena. He believes that he has found "cancer fields" in England, where,

with peculiarities of the soil, cases of "cancer" abound. Mr. Haviland has observed that where primitive rock formations exist, the neoplasm is comparatively rare, but as we descend to the bed of the rivers, and reach the tertiary formations, and especially low-lying alluvial lands that are subject to frequent inundation, "cancer" is met with much oftener. I am not aware that any one else has investigated this subject with the same degree of acumen that Mr. Haviland has shown, or obtained Mr. Haviland's results; but the hypothesis possesses some claims to being a possibility. It is quite well established that true goitre, a peculiar glandular hyperplasia, is a chronic endemic—miasmatic,—neoplasm; a peculiar cell proliferation that is induced by causes acting from without the body. The same may be said of elephantiasis. Some external agency causes an error in cell genesis, and a local disease follows. Why may not the same be true of carcinoma? In the "cancer fields" of Mr. Haviland, as favoring the development of this neoplasm, the effect of inter-marriage, which is common in some of the provinces of England, enters as a factor, in the same way that any circumstance of life that tends to exhaust vitality would enter. Climatic influences in the history of carcinoma may be limited to the position of developing latent germs, but it does not seem improbable that to this cause may be attributed, through nutritive errors, a sufficient change in cell genesis to give rise to a center of pathological proliferation.

Within the past few years, attention has been directed to the study of the relation between certain chronic diseases of the skin that covers the nipple and areola, and the development of carcinoma of the breast. The skin lesion is spoken of as eczema, but the descriptions of the several observers differ so widely, that one is inclined to doubt whether the same disease has furnished the groundwork for all the cases reported.

There is no anatomical or other reason why the mammilla should be exempt from eczema; indeed it is found quite frequently to attack that organ during lactation. This fact, and the kindred one, that this phase of eczema is be-

lieved to be confined to women, to which sex carcinoma of the breast is not peculiar; and also the pathology of eczema—which we must define as a catarrh of the skin—renders it extremely questionable whether the superficial disease that has in some instances been observed to precede carcinoma, is in the strictest scientific sense this same eczema. It is of course possible that the papillary induration that follows a long lasting case of eczema of the mammilla may extend into the lacteal ducts and become associated with the epithelial proliferation of a developing carcinoma; but it seems to me probable that we have here an unfortunate confusion of terms, and that eczema should not be regarded as a direct factor in the ætiology of carcinoma of the mammary gland. When the two diseases appear together, or when one follows the other, there is more reason for regarding it as a coincidence, than as a cause and an effect.

There is, however, a disease of the nipple and areola that is intimately associated with the development of carcinoma of the breast, a lesion that superfically presents the appearance of eczema, but histologically indicates a different genesis. This disease, called by Dr. Thin, "malignant papillary dermatitis" of the nipple, and which I believe to be identical with "Paget's disease of the nipple," though the latter is called eczema, begins in proliferation of the columnar epithelium of the mouth of the lacteal ducts, and spreading deeper, involves the glandular apparatus. The connective tissue surrounding the ducts, and of the corium, is to a varying degree excited to proliferate, and the epithelial covering of the nipple and areola is lost by a rapid multiplication of its cells; the latter condition gives rise to a surface denuded of epithelium, and covered with a serous exudation, in which are found broken down epithelial cells; the whole furnishing a picture that has been mistaken for one of eczema. But what it is desired to emphasize here is, that the disease does not begin in the skin like true eczema, but has its origin in columnar epithelium, from whence it spreads to the superficial structures; and that the involvement of the latter, from which the disease has been named, is accidental to the

disease and not an essential feature of it. The true disease is in fact lobulated epithelioma, and not a cause of the tubular epithelioma that develops in the mammary gland, but may be the first stage of that neoplasm.

Starting thus in the multiplication of glandular epithelium within the galactophorous ducts, the neoplasm soon fills the acini and passes by infiltration into the connective-tissue stroma. Here the misshapen epithelial cells form links, or fusiform masses spreading upward until they penetrate the corium; the nipple also is frequently found to be invaded with the cells of carcinoma (Ziegler). Later the entire breast is transformed into a mass of epithelium derived cells, with a scanty connective-tissue stroma, sufficiently thick to hold the nutrient vessels. It is probable that new tumors, secondary to the primary growth only in the time of their occurrence, develop from the wandering cells, or from cells no more removed from normal histogenesis than the vacuolated cells of a low mammary stimulus, and having the same origin, form centers for carcinomatous develment in various parts of the breast. These new tumors by coalescing increase the degeneration of the gland, and the distruction of its substance.

A section of mammary carcinoma shows the mass to be composed of the cut ends of tubules, or tubules through which the section has run transversely (*tubular epithelioma*), lined with pavement epithelium, the spaces between which are occupied by embryonic or fibrous tissue (Cornil and Ranvier). No juice is obtained by pressure, but when scraped, a substance composed of variously shaped cylinders of pavement epithelium is found, also spindle shaped cells and free nuclei. Or the cut surface shows alveoli crowded with epithelial cells, and connective-tissue stroma infiltrated with the same bodies. The boundary of the epithelial mass that I consider the true neoplasm, though constantly yielding to the encroachment of the proliferating cells, which proliferation takes place at the periphery of the neoplasm, is always clearly defined; for as long as the connective tissue remains,—and it will remain until destroyed by pressure or the degerative metamorphoses that

follow inflammation of connective tissue,—though infiltrated with epithelial cells, anatomically it is to be distinguished from epithelial tissue.

The evidence is not strong in favor of an infection of connective-tissue cells by morbid epithelial cells, in the sense of converting the passive into the active bodies; or that a "spermatic influence" (Simon) is exerted by epithelial cells upon connective-tissue cells, by which the latter are converted into pathological forms similar to the former. Unless this method of the growth of neoplasms is made an exception to all known laws of histogenesis, the only sense in which it can be accepted that a "spermatic influence" is exerted by wandering germs upon the tissue elements of the spot at which they are arrested, is that the action takes place within tissue limitations. It is conceivable that a diseased epithelial cell can exert a harmful influence upon a healthy epithelial cell when brought in contact with it, though even this is opposed to the degree of susceptibility to external stimuli that healthy cells possess; but a more extended influence than this can not be conceded upon satisfactory evidence.

The connective tissue does not long remain inactive, but early in the development of this epithelioma, and sometimes accompanying the initial pathological changes, begins to develop new vessels, which induces fibrous hyperplasia. The meshes of the stroma are at this time seen to be occupied by embryonal bodies. The irritation caused by the disturbance of equilibrium between the development of epithelial and connective tissue in the mammary gland, is thus seen to give rise to an inflammation that by rendering the stroma dense and coarse, or by causing atrophy, or possibly hypertrophy of the fibrous tissue, induces a variety of changes in the microscopic appearance of carcinoma. The features of the stroma as well as of the epithelium, are not always well marked in carcinoma, for frequently the same tumor is found to contain almost every variation in arrangement that belongs to epiblastic neoplasms.

I can not but look upon the minute divisions and subdivis-

ions into which pathologists have tortured carcinomata, as somewhat fanciful, and as serving no practical purpose. "The existence of a substance cementing the cells together, the absence of bloodvessels, and the arrangement of the cells in layers of investment, are the three terms of the definition of epithelial tissues" (Cornil and Ranvier). Pathological epithelial tissue possesses the same arrangement, though subject to variations that correspond to their physiological prototype.

Between adenoma and carcinoma the histological distinction is made in the arrangement of epithelium and connective-tissue stroma. The former is a less vigorous expression of the neoplastic development, and differs from the physiological proliferation of the glandular epithelium, "in the first place by this, that the cells are piled up above each other, and that a regular fatty metamorphosis remains absent" (Rindfleisch). The carcinomatous growth shows the same proliferation and absence of fatty metamorphosis of the cells, which in itself constitutes the lacteal secretion, but the cells proliferate more rapidly and have no regularity of arrangement. The epithelial growth has broken through the acinus walls and infiltrated the connective-tissue stroma, and presents no resemblance to the mammary gland, while still preserving the simple glandular structure, non-vascular epithelial cells spread out upon a vascular basement membrane of connective-tissue. This comparison is here instituted to demonstrate that the difference between adenoma and carcinoma is one of degree, not of kind; of intensity of expression of the same neoplastic histogenesis.

At times it is difficult to distinguish between the two growths, for in some cases the characteristics of each appear side by side. That the adenoma, however, may degenerate toward the carcinomatous type is not, as we have seen, improbable; but generally the particular stage of mammary activity that is represented by the adenomatous hyperplasia, is, save for the metamorphosis to which in common with other morbid growths it is subject, well preserved during its life cycle.

The clinical history of mammary carcinoma presents for

consideration three well marked features : *first*, after the growth is removed, a similar neoplasm generally appears at the site of the one excised ; *second*, the contiguous tissues and lymphatic glands become infiltrated with the elements of the neoplasm, and give rise to secondary tumors ; *third*, malignancy. The latter feature is the sum of the former two. We will try to discover why this is so.

The recurrence of carcinoma is a direct result of the nature of the neoplasm. Its growth is mainly peripheral, and in an organ like the mammary gland, invades every part by means of the lacteal ducts along which the primary growth probably extends. The absence of a capsule, and the infiltration of connective-tissue stroma with epithelial cells, it may be, at first inactive, makes the neoplasm much more extensive than at first appears, or than there is any reason to suspect, save from the evidence furnished by the microscope. The metastatic growths, in fact the general invassion of the system after the primary tumor has begun to grow, renders it impossible to remove the entire mass of abnormally proliferating and situated epithelial cells. The recurrent growths therefore, generally have their origin in some cells that have remained in the tissues after the excision of the tumor. Such cells, even though inactive at the time of the operation, need for their proliferation no other stimulus than the cachexy that has followed the development of the primary tumor, and lymphatic infiltration. Before the neoplasm has been recognized as a carcinoma, the disease, from being first local, has invaded the connective tissue to such an extent as to make its removal impossible. Moreover, it is probable that carcinoma rarely develops from a single focus, and any one of these, though situated remotely from the breast and quiescent, can send germs to the spot where the irritation of inflammation has taken the place for a time, of the irritation of the neoplasm. The infiltration of the connective-tissue stroma of the gland, may be regarded as the forerunner of the gradual occupation of the entire breast with the epithelial growth. It is the method of extension of the neoplasm.

In view of the relation between the waste cells of lactation

and mammary neoplasms, is it not too exclusive to refer the entire process of infiltration to cells that have wandered from the central or primary tumor. May not the connective tissue in a measure be occupied by waste cells that by diapedesis have passed into its stroma; waste cells, that by proliferation give rise to epithelial nodules that in time go to increase the size of the primary tumor.

There is no great difference in kind between the infiltration of connective-tissue stroma and the infiltration of lymphatic glands with cells from the primary growth, excepting that to the latter is added the "spermatic influence" of the morbid cells upon the endothelial cells of the lymph channels. As before said, I find nothing to establish a belief that this influence is more than a stimulus to the proliferation of endothelial cells, in the same sense that the connective-tissue cells are excited to proliferate by the epithelial embolus. The slight difference that exists between epithelial and endothelial cells, save in the matter of their germinal origin, would render a distinction between their pathological proliferation a matter of difficulty; and the appearance presented by the secondary lymphatic carcinomatous nodule, that "the structure of the lymphadenoid tissue consequently appears to go over directly into the structure of the carcinoma, the reticulum into the stroma, the lymph corpuscles into the caricinoma cells" (Rindfleisch), is probably due, not to a conversion of endothelial into epithelial bodies,—for until it is certainly disproved, "it is well to hold the doctrine of Remak and Goodsir, that as the descendants of the different embryonic layers are never transformed into each other in normal circumstances, so also under pathological conditions, no such metaplasia can occur" (Ziegler)—but to a proliferation of the two histological elements in the same growth.

Reference to the anatomy of the lymphatics and their office in lactation, will render simple an understanding of the method by which carcinoma cells become arrested in the filtering apparatus of the gland, and there give rise to secondary tumors; for we must look upon the secondary nodule of the mammary and axillary lymphatics, as devel-

oped from wandering progeny of the primary carcinoma of the breast, and also it may be from the waste cells of spurious evolution and involution of the process of lactation; but in either event the parent cells have their seat in the mammary gland, and their offspring pass from thence into the lymphatic glands on their way to the general circulation. Some of the morbid cells succeed in passing through the gland, while others remain on the afferent side of the depuratory apparatus, and there finding conditions favorable to development, proliferate, and give rise to a secondary tumor that corresponds in every particular of structure to the primary growth.

While in accordance with the above principles of histogenesis it can not be conceded that the lymphatic glands are converted into epithelial cells of the mammary tumor by any influence that the latter may exert, there is apparently some force resident in the primary neoplasm as a whole, or in individual parts, that excites the lymphoid cells of the follicular tissue to enlarge, and become invested with cell substance, and the fibers of the lymph-sinuses to swell up into broad bands; thus in the one instance allowing the waste cells to pass into the parenchyma between the constant gland elements, and in the other, preventing the waste cells, or wandering epithelial cells, from passing through the gland and entering the afferent vessels before there is any appreciable collection of the neoplasm in the gland, that is, prior to the formation of a secondary nodule. The degree of intensity of the tumor disease is well marked in this very process of secondary development; for if the infectious, or contaminating power is low, the changes in the lymphatic gland may be, in part, or wholly limited to an endogenous cell proliferation into the parenchyma of the gland; but if the infectious quality is intense, to it is added a development of the imported epithelial cells, and together they build up a tumor that envolves the entire gland.

The superlative malignancy of epithelial neoplasms is not satisfactorily explained, either by the fact of recurrence after their removal, or by the development of secondary

tumors in the lymphatic glands. The generally excellent health of the patient before the tumor is observed, contrasted with the sapping of vitality, the wasting of tissues, and general evidences of malnutrition that mark the progress of the disease, bear testimony to the fact that epithelial tissue is in a peculiar manner and degree associated with the harmonious working of the organism. We have, therefore, to inquire: *first*, as to the office performed by epithelial cells; *second*, as to the nature of the changes wrought in these cells, in the process of neoplastic histogenesis.

All varieties of epithelial cells possess this in common, they are not stable elements, in the sense that fiber cells are permanent constituents of the organism, but are "transitory; they are created, developed and die, in a varying space of time;" (Cornil and Ranvier). Of the variety of epithelial cells that is concerned in the neoplastic histogenesis—the glandular—this is especially true. They multiply and desquamate rapidly, and are, consequently, as during a period of the functional activity of the mammary gland, not mature cells, but young, imperfectly formed bodies. Now it is probable, that the progeny of a secreting cell, however much they may differ from the parent cell, retain some of the characteristics of that cell; that they still possess, though in a distorted degree, the discriminating and elaborating powers of the parent, and so on for generations, the secreting power remaining in the offspring, though becoming more and more unlike the parent as it is further removed from it. Each cell of a gland represents the gland function, and is capable under favorable conditions of carrying on the process of secretion; that is to say, the individual gland cell, though isolated, when in a favorable situation will take to itself peculiar elements from the blood, divide, and give rise to progeny that are capable of carrying on the same process; all that is required is a vascular basement membrane; an excretory duct is not essential. Epithelial neoplasms, as we have seen, consist of an excessive proliferation of secreting epithelial cells, that correspond to certain definite but immature stages in the

lacteal process. The progeny of these cells still possessing powers of secretion, overflow into the surrounding tissue, and there set up a process that repeats their morbid endowment of proliferation and secretion. There are thus formed multiple gland centers, each one drawing upon the blood for support.

Let us carry this hypothesis a step further, and see these morbid cells extracting from the blood elements that are essential to the life of the organism, elaborating these within its own laboratory, and upon the breaking up of the cell, discharging its contents in the meshes of the connective tissue. Is there not here found at least one series of causes that contribute to render epithelial neoplasms so entirely incompatible with health and life? Are we not justified in thus accounting for the constitutional involvement that follows slowly upon the development of the primary tumor, and more rapidly upon the multiplication of the neoplasm, and implication of the lymphatic glands? The extension of the pathological centers increases the malignancy of the neoplasm, which malignancy must be thought of as residing in the neoplasm; for each tumor adds its force, in taking nourishment from the system, and, it may be, at the same time discharges into the blood a poison of its own manufacture.

Carcinoma of the mammary gland belongs anatomically to one class—pavement epithelioma. In this form of epithelial cells the endogenous cell formation begins, and whatever clinical history individual forms may present, or variations in the arrangement of their constituents, depend upon the stage and degree of glandular activity in which the neoplasm began; their situation, and the condition of their matrix.

Two forms are developed in the breast, however, with sufficient distinctness to render a division into soft or medullary carcinoma, and hard or scirrhous carcinoma, practicable. Both are infiltrating growths, and the difference between them arises from the proportion that is made to exist between the epithelial cells and the connective-tissue

cells, as well as the degree to which the connective tissue is involved in the morbid process.

Carcinoma of the mammæ begins as a small, hard, painless nodule, situated rather deeply in the substance of the gland, involving, as it does, one of the gland acini. Rarely does the neoplasm begin with a proliferation of the epithelial lining of the entire gland, or an infiltration of the connective-tissue stroma; these are stages in the evolution of the primary nodule. The hard uneven tumor that marks the initial stage in the development of carcinoma, is at first movable under the skin, but is adherent to the substance of the gland. This tumor may remain indolent for a year or more; but occasionally shows a slight sensitiveness at the menstrual period, if menstruation has not ceased. Up to this time the patient remains in good health.

As the tumor begins to enlarge, symptoms of infiltration show themselves. The integument becomes adherent to the growth beneath, the tumor seems to spread by involving more of the gland divisions, the lymphatics are felt to enlarge, and the lymphatic glands become hard. Gradually the mammary neoplasm and the lymphatic nodule, "unite so as to form a nodular, (?) movable swelling which at some points adheres to the skin" (Billroth). The arm soon begins to swell, and the tumor becomes the seat of piercing, burning pains of great severity. To these local symptoms, are added constitutional disturbances of a grave nature. The patient's complexion assumes a waxy appearance, and her hands become almost transparent. There is great loss of strength, and hectic symptoms. As the tumor increases, and involves the superficial structures, the latter break down and take on a low degree of ulceration, with most foul discharge. It is peculiar of this ulceration, that it shows no disposition to invade the skin beyond the boundary of the carcinomatous infiltration, or the size of the tumor beneath; and also, while the edges of the ulcer are more or less congested and red, the contiguous-tissues are apparently healthy. If the mammary neoplasm has been rich in blood vessels, that is if the connective-tissue stroma contains a large blood supply, or has been excited

to proliferate, and to form new blood channels, the ulcer assumes a fungoid appearance, and may give rise to most profuse and dangerous hemorrhage, which in itself threatens a fatal issue.

The cachexy of carcinoma is at this time well developed, and we may look upon the pains that accompany breathing, as an extension of the disease to the deep mammary lymphatics, and through those to the lymphatics of the thorax. Pain, exhaustion and sapping of vitality, soon bring the disease which has lasted from two years to two years and a half, to an end.

It is noticable, that during the period covered by the development and growth of the mammary neoplasm, the breast has not increased in size, it has rather contracted, and is less voluminous than before the neoplasm appeared, a fact full of significance in the histogenesis of carcinoma; for it furnishes additional support to the hypothesis, that carcinoma of the mammary gland occupies the gland substance by first destroying it; that as the epithelial cells proliferate, the connective-tissue must yield, and give place to their increasing number.

The increase of mammary carcinoma is slow, and not in proportion to the systemic disturbance that is set up by it, or the number of secondary tumors that have their origin in cells that have migrated from the primary growth; hence it appears that the size of the parent tumor has little to do with the power of contaminating the system.

Mammary carcinoma usually develops from the thirtieth to the sixtieth year, rarely earlier, rarely later than that period of life, its maximum of frequency being about the forty-eighth year; but few cases have been reported of the disease developing before puberty.

The social state seems to have very little influence on the development of carcinoma of the breast. The married and unmarried; those who have borne children, and those who have not; the rich and the poor, are alike affected, and with no such difference in proportion as to establish in favor of one estate over another. Statistics however, constitute a very untrustworthy guide, for they deal with only

one set of phenomena; the concomitants, which are of great importance, do not find a place in them.

In conformity therefore, with the general law, that the use of an organ, that is to say, its functional activity, furnishes an immunity against disease, we are inclined to believe that normal pregnancy and lactation are antagonistic to the development of mammary neoplasms, and especially to the genesis of carcinoma, which, more than any other neoplasm of this organ, is concerned with its functional activity. If pregnancy and lactation follow an abnormal course, and there can be no doubt that the requirements of modern life predispose to departures from healthy reproduction, there exist conditions that favor the development of mammary neoplasms. These conditions receive no place in the statistics of the diseases of the breast.

The history of the mammary gland, however, its development, its periodic evolutions and involutions and its final upfolding, furnish data that go to prove that here, more than in external agencies, or even lactation that deviates from a normal course, are to be found circumstances that favor mammary carcinoma. During the developmental stage epithelial neoplasms are extremely rare, but during the resting period, and especially when the organ is closing its glandular office, and the entire organism is passing toward that equilibrium which in perfection constitutes dissolution; when the repair is no longer so much in excess of the waste as to stimulate to evolution, but the highest form of that organism having been reached, it begins a preparation by which it shall be removed to make room for other organisms, carcinoma mammæ finds conditions that favor its development.

The influence of trauma upon the development of carcinoma of the breast can not be disregarded. Not that an injury is capable of inducing pathological changes in the glandular epithelium; but upon the hypothesis that carcinoma may arise from undeveloped gemmules, the vascular disturbances following a blow, and the processes incident to repair may induce proliferation of the gemmules situated within the radius of the injury; and the changes in the connective-

tissue that are of a nature to enlarge the lymph spaces, are favorable to the migration of the epithelial cells. An injury, however, as we shall see, is much more likely to be followed by the rupture of a limited spot of the connective-tissue vacular system, producing a cyst filled with blood—*hæmatocyst.*

Carcinoma of the mammæ usually occupies one breast, most frequently the right, in the upper portion of the outer hemisphere, but the primary nodule may develop in any part of the organ, or in the nipple itself, from thence involving the gland tissue.

α. Medullary Carcinoma, begins in a proliferation of the large granular cells of lactation. The power of proliferation is carried on rapidly, and because of some peculiar conditions of the connective-tissue stroma, infiltration into the lymph spaces of epithelial cells, is especially marked, and the connective-tissue cells are excited to rapid multiplication ; this, added to a probable mucous degeneration of the pathological bodies, conduces to make the neoplasm soft, rich in cells, poor in connective-tissue, and pervaded with more or less fluid. The connective-tissue stroma is sometimes entirely wanting, its place being occupied by vacular trunks which seem to pass in the interstices of the medullary cells, and are then all that remain of the walls of the alveoli of the gland ; or the vascular canals are formed entirely by the cells of the neoplasm, and ramify in every direction ; in either condition, the neoplasm becomes a mass of embryonal blood-vessels and large endogenous epithelial cells, and is properly called *telangiectatic carcinoma.* In other cases the stroma only becomes mucoid, and an examination of the tumor shows nodules of large epithelial cells, surrounded with, and separated by tracts of mucoid tissue. These neoplasms are very soft, and show a history of extreme and rapid malignancy.

These anatomical conditions and relations favor early infiltration of the mammary lymphatics and the axillary glands, and hence the development of secondary nodules. The same causes induce breaking down of the integument, and compared with other forms, medullary carcinoma

ulcerates early in the history of the neoplasm. The discharge from the ulcer, according to whether the neoplasm is more or less rich in blood vessels, may become a dangerous hemorrhage, but generally is a sanious discharge, most offensive, irritating, and mixed with broken down epithelial cells.

Medullary carcinoma is a very rare disease of the mammæ, and perhaps in that gland its most frequent form, at first, is that of a tumor, separated from the healthy structure by an exceedingly thin capsule; but I am led to believe that this capsule is not permanent, and that infiltration of the mammary and axillary lymphatics, indicates a breaking down of this capsule, which probably is the remains of the acinous wall in which the endogenous process began.

Medullary carcinoma is usually developed near the surface of the gland. The tumor is oval or rounded, usually smooth, sometimes quite hard on the surface, communicating a sensation to the hand as of a cyst in the center of the growth. Until superficial ulceration begins, the skin covering the tumor is not infiltrated, and even then it can not always be ascertained that the breaking down of tissue is the result of an invasion of medullary cells. In consequence of this immunity the skin does not often become attached to the neoplasm beneath, nor does it contract as is frequently observed in the firmer carcinoma; indeed the medullary growth is rather situated upon the healthy structures than within them, and projects from the gland.

Medullary carcinoma of the breast belongs to the resting period of the gland; that is to say, the physiological period that intervenes between the development to a possibility of full functional activity, and the final subsidence of the function. Its cells represent a feeble excitation of the lacteal process, and we have seen that during the entire period of reproductive activity, spurious excitation is liable to occur.

The diseases of medullary carcinoma are: atrophy; fatty and calcareous infiltration; and mucoid softening. Atrophy and spontaneous disappearance of medullary carcinoma is rare, and usually such a history is deceptive, for the disease returns in a few months. No satisfactory explanation has

been found for the efforts of such a malignant growth to return to a state of health, but it probably has to do with the cutting off of the supply of nourishment. Possibly the blood vessels become occluded with epithelial cells, and for a time are thus prevented from circulating the quantity of blood required by the rapidly growing neoplasm.

Fatty infiltration and metamorphosis do not differ here from the processes that we have already studied in relation to other neoplasms. The cells become yellowish white, friable, and greasy to the touch, in a state of "saponification" (Rokitansky). Fatty and mucous metamorphoses are of frequent occurrence.

Calcareous metamorphosis is very rare in medullary carcinoma. The deposit of the limy salts is always attended with an increased flow of blood to the part, and a stagnation of the nutritive fluid. The stroma only is affected. By this metamorphosis the medullary growth is arrested, for it places a boundary to the multiplication of the carcionomatous cells, until the calcareous cells in their turn are excited to morbid activity.

Cysts are frequently developed in medullary carcinoma. We do not here speak of cysts of retention, but of neoplastic cysts caused by internal softening of the neoplasm. The process by which this is accomplished is usually one of mucoid or colloid degeneration of the epithelial cells. The cyst possesses no distinct wall, its boundary being set by the firmer cells that have not undergone metamorphsis. If the mucoid softening begins in the connective tissue stroma of the neoplasm, a cyst wall may be formed out of that tissue. We must, therefore, regard these cysts as marking a further degeneration of the neoplastic cells; but a degeneration of such frequency as to be considered incident, if not accidental, to the morbid growth. The cysts are filled with serum variously tinted, or with pure blood. They are also said to have been found with a solid substance resembling the matrix in which they develop. The cysts are rarely single, and sometimes are so numerous as to crowd out and displace the carcinomatous tissue, which in extreme cases only occupies the interspaces between the cysts. The

neoplasm then becomes extremely soft, and partakes of the nature of a gelatinous tumor.

The diagnosis of the presence of cysts in medullary carcinoma, will depend upon the firmness of the parenchyma; if this is soft, it becomes extremely difficult to distinguish by the touch the existence of a softer spot. The aspirator is always a most valuable aid to the diagnosis of doubtful cases; its use, however, is not in carcinomata, without danger, for if the neoplasm is vascular, hemorrhage may follow that would be difficult to control; and the puncture made by the needle, as in the case of sarcoma, may result in breaking down of the integument, and the development of fungoid granulations that protrude from the wound. Excepting in extreme cases, and such it is difficult to picture, it is not advisable to aspirate a medullary carcinoma.

Cysts have been observed most frequently in medullary tumors that grow rapidly; I am not aware that they have been found in the secondary nodules developed in the axillary lymphatic glands.

β. Scirrhus, like medullary carcinoma, has its origin in an endogenous cell formation of the epithelial cells of the terminal vesicles of the mammary gland. By proliferation of these cells, the tubuli and acini of the gland are filled with bodies that show no disposition to the vacuolation process that results in the formation of mucus, or to pass on to the fatty metamorphosis of lactation. The cells remain small, and even contract, by the absorption of their fatty constituents, whereby there results a general shrinking of that part of the gland occupied by the carcinomatous growth, with drawing in of the integument and the nipple, when the larger lacteal ducts leading into that body are invaded by the metaplasia.

Though in scirrhus there is an infiltration of the connective tissue stroma of the gland, and to such an extent as to form nodules, that, uniting with the primary tumor increase the circumference of the neoplasm, the connective tissue, to a limited degree only, participates in the morbid process. This is especially marked, in the absence of softening, and an increase, rather than a destruction of the

fibrous stroma. The hard carcinoma, therefore, while it is truly an infiltrating neoplasm, is in, not of, the mammary gland. While it spreads in all directions, and invades every tissue, its boundary can be determined ; the line between epithelial and connective tissue cells is not occupied by embryonal cells.

Upon section, scirrhus is seen to project into the connective tissue, and follow the lymphatics, so that it has the appearance of tubuli filled with masses of small epithelial cells. The interlobular spaces are occupied by a dense, coarse connective tissue stroma, and the gross picture is that of small islands of epithelial cells, surrounded by broad bands of fibrous tissue.

The hardness of scirrhus depends upon the peculiar manner in which the cells are packed in the lacteal ducts, and also upon the disposition on the part of the cells to lose their nucleus and become converted into formed material. Scirrhus is not uniformly hard in all its parts. The soft portion is peripheral, because last formed, the hard portion is central, because first formed, and between these two there is almost every gradation of firmness.

The primary disease is reproduced in the axillary lymphatic glands, but not early in the course of the disease. The glands become hard, not swollen, but contracted, and the lymphatic channels connecting them with the breast, later in the disease, feel like hard cords. There is everywhere found the same small cells, with the clinical history of hardness and contraction.

Schirrhus of the mammæ is first observed as a small hard tumor, adherent to the gland tissue, and generally even in the early stages, to the integument. The surrounding tissues remain healthy. The tumor is well defined, and when manipulated can be separated from the adjacent tissues within certain limits, though the absence of a capsule, and the peripheral encroachment of the neoplasm, show that this separation only marks the advancing line of the pathological process.

In this condition the nodule may remain for months, but usually there is a perceptible increase in size. At first the

tumor is so small and free from pain as to attract little attention, until a blow, or other injury to the breast, leads to an examination; or its presence may remain unsuspected until the tissue around the nipple and the nipple itself, become drawn toward the chest, and where the neoplasm is situated, the breast becomes contracted, sinking below the surrounding parts.

When the tumor has existed a variable length of time, secondary nodules develop in the mammary lymphatic glands, and later in the axillary glands. These secondary tumors, if the disease remains unmolested, usually develop about midway between the first evidence of the neoplasm, and death. Sometimes the lymphatic tumors are larger than the mammary tumor; occasionally they are developed simultaneously, though this is rare.

Scirrhus tumors may never proceed beyond the small hard growth decribed, but usually they show marks of degeneration before they have existed a year. The changes are either central or peripheral, and result in atrophy, the formation of pus, the deposit of limy salts, or in ulceration.

Simple atrophy is frequent, and is associated with fatty metamorphosis of the epithelial cells. The atrophied tumor becomes smaller and harder, the central nodule draws the surrounding tissues of the breast inward, the nipple is retracted, and where formerly there was a prominence, there is now a depression. This, as has been said, depends upon a cicatricial contraction of the larger milk ducts and consequent drawing inwards of the mammilla. The blood vessels become small, and are in places entirely obliterated. It is probable that the fat with which the cell is filled, is not obtained outside of the cell, but arises from reseparation of the albuminates and fat, the principal constituents of the cell contents. The central formation of pus in scirrhus is rare, and is usually confined to the superficial nodules of the growth. The process is one of slow inflammation,—which inflammation accompanies all stages of scirrhus,—causing metamorphosis of epithelial cells, rarely of connective tissue, the migration of white blood corpuscles, and the for

mation of pus, or caseous accumulation. These softened spots range in color from a whitish-yellow to a dark gray or red.

There are two varieties of ulceration, one, proceeding from within outward, has been described ; the other has its origin in an abrasion of the skin that covers the tumor. The ulcers are not deep, but show a tendency to spread. The margins adhere firmly to the tumor beneath, are not inflamed, and are for the most part irregular in shape, raised above the base of the ulcer, and everted, with the appearance of being gathered on a string. Where there are several ulcers they rapidly coalesce. The bottom of the ulcer presents a gray or reddish-green color, is uneven, soft, and covered with luxuriant granulations that give it the appearance of villous carcinoma. The patient usually dies during the ulcerative process.

Calcification is a rare metamorphosis. When it occurs, the stroma is more frequently affected than the epithelial cells. The process appears in isolated nodules which become of stony hardness, and is usually associated with other forms of degeneration.

The most frequent seat of scirrhus is the female breast. The neoplastic process belongs to declining years, to the upfolding period of the mammary gland, to the subsidence of functional activity ; hence the atrophy of the secreting cells, which, under the influence of the neoplastic histogenesis, continue to proliferate, without forming milk. The disease occurs most frequently between the age of forty-five and fifty ; it is very rare before the twenty-fifth year, and after the seventieth year, though Mr. Birkett has reported a case of scirrhus in the breast of a child eight years of age.

Marriage seems to favor the development of scirrhus. The proportions in 260 cases mentioned by Mr. W. M. Baker, were :

Single, 23.0 per cent.
Married, 72.4 per cent.
Widow, 4.6 per cent.

But such statistics may mislead, for it is evident that the

only manner in which the simple married state, without the natural results of pregnancy and lactation could affect the development of mammary scirrhus, would be through irritation of the reproductive organs. The married relations are usually followed by conception, unless means are taken to prevent fertilization; and by evolution of the mammary gland, with lactation, unless the fœtus is destroyed before full term. These data, which with unfortunate frequency complicate the history of mammary neoplasms, do not enter into the statistics given, and still are of importance, as ætiological features.

In giving to spurious irritation of the mammary gland that has its rise in unnatural excitation of the reproductive organs, a place in the ætiology of scirrhus of the breast, there may be a seeming contradiction, for such excitations are more frequent in earlier life, when the reproductive organs are at their maximum of activity, and the sexual requirements more pronounced; but we must remember the power that cells have of remaining undeveloped in the organism—the undeveloped gemmules—and also that not all the cells of secretion are used in the production of milk in normal lactation, or become large granular cells in the spurious excitation of the mammary gland; and therefore, while the period for the growth of scirrhus begins with declining life, the genesis of the neoplasm may be placed in adolescence.

It is unusual to find both breasts attacked simultaneously, and quite rarely does a secondary tumor develop in the breast not first affected. Of one hundred and fifty cases, both breasts became diseased in only seventeen. In these seventeen cases, the right breast was first attacked in eight, the left in four instances, though Dr. Walshe believes that the left is more frequently scirrhous than the right breast. When the opposite breast is invaded, it occurs late in the disease, generally not earlier than the second year.

The average duration of life, from the time when the tumor is first observed, is four years; Sir James Paget says, that in sixty-six cases, tabulated without selection, he finds it something more than forty-nine months. Billroth places

the duration of the disease at between two and three years, but scirrhus is essentially a chronic disease, and appearing late in life, its course is not rapid, but slowly progressive.

There is a variety of carcinoma of great rarity in the breast, but which I can see no good reason for regarding as more than a variety of the scirrhus that we have been discussing. The neoplasm begins as a nodule in the gland, and spreads to the skin, the epithelium of which it invades. The disease, a little later, develops in the opposite breast, and gradually spreads, until it unites with the first tumor. In this manner, and by outward spreading of the neoplasm, the entire chest becomes bound together with an atrophied epithelial growth, which in its later stages may ulcerate, and produce a vast suppurating surface.

Treatment. The treatment of carcinoma continues to be a subject for discussion, and must remain undecided, as long as opinions differ concerning the period at which constitutional involvement begins; for here is the controversial pivot, whether the neoplasm precedes or follows, what we have learned to look upon as a general disturbance of the centers of nutrition. It may be averred without hesitation, that no unanswerable arguments have yet been brought forward, in favor of a primary constitutional disease for carcinoma. The persons when attacked are usually in excellent health, and not until the neoplastic growth begins to multiply is there any evidence of constitutional trouble. Until contamination of the absorbents, and of the system, which occurs late in the disease, about midway between the first manifestation and the conclusion, carcinomata present no feature that could be interpreted as belonging to any other than a local disease. The erratic proliferation begins at the point where the primary tumor is seated, and from thence emanate the baneful effects of the carcinomatous disease. This has already been treated of more at length in the ætiology of carcinoma.

A belief in the local origin of this neoplastic histogenesis does not, as might be supposed, solve the entire question of the principles of treatment; for, as has been seen, this theory of local origin must be made to include the possibility of

multiple germinal centers in the same organism, disease centers, that are ready under the required systemic conditions, to develop the characteristic tumor. If therefore we would cure the disease, we must remove each center that is capable of giving rise to the contaminating nodule. This it would obviously be impossible to do. In this necessity for treatment, we have one explanation of the clinical fact, that even though the primary tumor is excised before lymphatic infiltration or constitutional involvement, while still it is a local disease, the growth returns either in the cicatrix or vicinity, and the progress of the neoplastic development is not always arrested. It must therefore be confessed, that operative interference does not hold out the hope of a certain cure of carcinoma; but on the other hand it is probable that life is frequently prolonged, and made endurable, by excision of the tumor in its early stages, for there is reason to believe that the forces that conduce to develop the carcinomatous gemmule, if this is inherited, or the disease has remained dormant in the system for a length of time, having arisen *de novo*, sometimes find their measure of expression in the genesis of a single neoplasm; and hence when this is removed, unless from a recurrence of such forces —to predict which is impossible,—there is reasonable grouna to anticipate a cure.

If carcinoma is not cured by an operation, the progress of the disease is retarded, for not only is the growth of the individual genetic center operated upon stopped, but as much of the contaminating influence as that may represent, taken away. Dr. S. W. Gross, an advocate of operative treatment, is convinced that an operation "adds twelve months to the life of the patient," and Mr. Jonathan Hutchinson believes that if the tumor is removed in its early stage, the disease could thereby be eradicated.

Carcinoma generally returns within the first half of the year after its removal, but this depends upon the time at which the operation is performed, for probably the age or period of evolution of the neoplasm is not without influence in causing its rapid or slow return. There is a slight difference between the rapidity with which scirrhus and med-

ullary carcinoma return, in favor of scirrhus. But in connection with this it has been shown that the softer neoplasms possess marked infiltrating properties, and hence the greater difficulty in making a complete excision of the diseased cell area. It is therefore probable that the rapid regrowth of medullary carcinoma after removal, is in a degree an instance of continuous growth.

If the patient remains free from the local disease for three years after the operation, and internal organs are not involved, there is a reasonable hope that the disease has been eradicated.

It is a significant fact in relation to the widespread, but not always known limits of carcinoma, that after the removal of the diseased breast without the axillary glands, they not being involved, the disease returns more frequently in these lymphatics than at the seat of the primary nodule. This fact has also a practical bearing upon the operation itself, for if the disease returns more frequently in the axillary glands than in the breast, it is certainly justifiable to remove the lymphatics even though they show no evidence of infiltration from the mammary tumor. Their removal does not complicate the operation on the breast to such a degree as to be urged against the more complete operation, and the advantages that may follow such an operation are sufficiently pronounced to speak in its favor. Were it possible to remove all the lymphatics connected with a carcinomatous breast, we might with reason entertain a better hope of effecting a cure. The neoplasm could then spread only by infiltrating the connective tissue stroma, for carcinoma does not travel in the course of the blood vessels, and internal organs would thus be insured against contamination through lymphatic channels. To do this is impossible, but we approach such an operation when we remove the breast and the axillary glands ; and I am led to the belief that the success of the operation bears a definite relation to the thoroughness with which the lymphatics, not only the mammary gland, are removed.

The medical treatment of carcinoma of the breast can

not be said to add much to the successful management of the disease. Dr. R. S. Gutteridge has reported a number of cases of what he calls *cancer*, cured with medicine, but from his conception of "cancer," as defined in the pamphlet in which he mentions these cases, as well as from the description of the cases, one is led to question the correctness of his diagnosis, to hesitate, before regarding the tumors "cured," as example of those malignant neoplasms, which in our nomenclature have been studied as carcinoma. I would be only too willing to believe that surgery will not always be obliged to bear the opprobrium of being able to offer nothing better than the knife for carcinoma, but at present this is unfortunately true; after the stage of activity begins, the period at which a correct diagnosis is possible, medicine will palliate, but seldom cure. Notwithstanding this grave outlook, to medicine must we turn for a cure, if one is possible, at this stage of development. The medicines that have done the most for mammary carcinoma, are *iodide of arsenic*, *iodide of calcarea*, *cicuta*, *conium*, *hydrastus can.*, *phytolacca*, *arsenicum*, *asterias rubens*, *aurum*, *galium aparine*, *carboneum sulph.*, *ranunculus*, *rabinia*, *sanguinaria*, *thuja*. These drugs, with probably many others, correspond not only in symptomatology, but also in their pathological action, which together make the complete similium of the disease to the carcinomatous heteroplasia.

Daily accumulating experience, leaves little doubt that in some diseases the action of medicine administered internally, is rendered more effective by the local use of the same drug, or possibly some other drug, the combined action of which is indicated by the particular phase of the disease. By this method of treating disease the organism is converted into a laboratory, and we can form a conception of this laboratory being situated where the drug forces exert and expend their greatest activity. One advantage therefore that may be expected to follow the external and internal use of medicine, is the localising, the concentrating, of medicinal forces; and when such an emphasis is required at a given point, at the same time that the organic forces

must be met through the general channels of absorption, this method of treatment should be of service, hence its efficacy in specific diseases that expend their malignancy in local tissue metamorphoses. Carcinoma comes within the above definition, and situated in the mamma, because of the exposed position of the organ involved, affords a favorable opportunity for exhibiting what may be called the combined method of treatment.

Bearing in mind the claim advanced for the combined method of treatment, localization, and the determining power of the external application, it follows that the best results will be obtained the nearer to the pathological center the external and the internal forces are brought together ; that is to say, the allied forces which constitute the drug disease, should be made to combat the organic disease in the neoplasm itself. This can best be accomplished by hypodermic injections into the tumor. For this purpose I have found three drugs of service, probably increased experience will add to the number : *conium mac.*, *hydrastus can.*, and *phytolacca dec.* These used hypodermically, in connection with the same medicine given internally, or the *iodide* of *arsenic*, or *iodide* of *calcarea*, have in my hands, when an operation could not be performed, done much toward arresting the progress of carcinoma of the mammæ, I think prevented further infiltration and metastasis, and relieved intense suffering when a cure could not be expected.

The formula used has been :

℞.—— fluid extract . .	2 parts.
Glycerine	1 part.
Bichloride of mercury .	1.1000.

Of this I have injected into the tumor, with Declat syringe, 10 to 20 mm. every day, with possibly an increasing dose. The bichloride of mercury is added to prevent any suppuration, or breaking down of the neoplasm that might result from introducing the syringe, or the injection. This treatment must be continued when once begun, for it has not cured ; it has, as far as I know, only arrested the pro-

gress of the disease. The size of the injections and their frequency can be diminished as improvement takes place, but it is probable that the abnormal cell genesis must constantly feel the force of the drug used.

The treatment of neoplasms with subcutaneous injection, and the internal use of phenic acid advocated by Dr. Declat, have been disappointing. To ascertain the opinion of other surgeons upon this question, I requested by mail the experience of surgeons in different parts of this country. The opinions received were almost unanimous in regarding this method of treatment in no other light than an uncertain palliative. It relieves pain, but does not arrest the course of the neoplastic disease, nor does it act specifically upon the carcinoma cells. My own experience with Dr. Declat's treatment, both in neoplasms of the mammæ and in other situations, is an agreement with that of the surgeons who courteonsly responded to my request for information upon this matter.

c. Cysts.

In entering upon the study of mammary cysts, we are considering a true epithelial neoplasm, but a neoplasm that is composed of the product of epithelium, and not of epithelium itself. A distinction is here made between neoplastic cysts, those that are secondary formations in the pathological mass in which they develop, and which must be looked upon as an internal softening of the primary tumor, and the cysts that are themselves the primary tumor, that result, not from a degeneration of already existing pathological cells, but that have their genesis either in the process of secretion that from some accident is prevented from discharging, or in a spurious repetition of the developmental changes that result in the formation of composite glands. The former furnishes an example of cysts of retention, the latter of cysts formed *de novo.*

Cysts are spherical in form, and when situated in the breast, unless distorted by external pressure, form small round tumors that project more or less from the surface of the gland, according to their depth from the surface

of the breast. They form hard tumors that are movable upon the chest walls and within the gland. When only slightly covered with tissue, the superficial veins may be enlarged.

Retention cysts are of quite frequent occurrence in the mammary gland, and result from the closure of a galactophorous duct, while the endogenous cell formation of lactation continues in progress. The closure of the duct is usually accidental. The contents of the cyst is rarely milk, but some substance, fluid it may be, that corresponds to the stage at which the function of that particular cell area of the mammary gland was arrested,—the degree of functional excitation. Hence the cyst may be filled with large granular cells, or with cells that have passed into fatty degeneration, or caseous detritus, in which case the tumor becomes so firm as to give the impression of a solid neoplasm. Though the cyst contents may be taken to represent a stage of mammary evolution or involution, the formation of the intracystic substance is not of necessity dependent upon the process of lactation, but may receive its impulse from a spurious excitation of the mammary function, the duct having been previously closed.

The cyst walls are composed of the basement membrane, with usually the epithelial covering of the lacteal duct, though its place may be occupied by a "nucleated structureless and striated blastema, at the circumference of which the oval nuclei are in the act of splitting into fibers in the direction of their long axis."—(Rokitansky). Sometimes the lacteal tubes remain sufficiently open to permit the fluid contents of the cyst to be pressed from the nipple; it rarely flows from the cyst spontaneously.

The cyst may be so small as to attract no attention before the gland is removed for some other disease, or attain the size of a double fist. The mammary cysts are frequently multiple, especially when occurring after the menopause, and then contain a greenish, more or less solid substance. The single cyst, which occurs most frequently during the evolution of the gland, though there may be hundreds of small cysts scattered through the gland substance, de-

veloped at this period, is usually situated in the center of the breast near the nipple.

The axillary glands are sometimes indurated, a fact that does not complicate the primary disease, and that has no particular pathological significance. The lymphatic enlargement is not any extension of the mammary neoplasm, but arises from the disturbance of the physiology of the lacteal organ.

Occasionally there are found in the breast cysts containing blood, that are the result of an injury. These are of two varieties. One follows the rupture of a blood vessel in the connective tissue, and contains pure blood, and does not come within our definition of a neoplasm ; the other, which has a well-developed cyst wall lined with epithelium, I would place among the cysts of retention, and hence regard it as an epiblastic neoplasm : not, of course, with the intention of expressing so grievous an error as to say that the contained blood is derived from the epithelial cells of the cyst wall, but with the intention of placing the injury as an ætiological factor of the first importance, and a hitherto obstructed duct or acinus, in which no secretion has yet taken place, as the cavity into which the blood exudes. That in this manner the obstruction of a lacteal duct may antedate the development from it of a cyst, there are many reasons for believing, found in natural and spurious evolution and involution of the lacteal function ; and that this portion of the duct is occasionally the reservoir of blood flowing from ruptured vessels of the vascular system of the basement membrane seems probable, when viewed from two different standpoints, *viz.*, the contents of sanguineous cysts of the mammæ is rarely pure blood, but mixed with mucus and broken down cell derived elements ; and, blood effused into the alveoli of the connective tissue stroma of the gland is soon absorbed, after the same method that obtains when blood is effused into connective tissue in other parts of the body.

The diagnosis of sanguineous mammary cysts is sometimes difficult to establish. It must rest principally upon the evident traumatic origin of the tumor ; its rapid growth,

when compared with the growth of carcinoma; the absence of inflammatory phenomena, when compared with those that attend the formation of pus; and the fact that the traumatic cyst after attaining a definite size ceases to grow.

The second method of the formation of cysts of the mammary gland—*de novo*—is, I think, of more frequent occurrence than there are positive data from which to draw such a conclusion. Keeping before us, however, the law, that pathological processes find their prototype in physiological processes; that neoplasms have their beginning in normal cell proliferation; and also drawing an analogy between the mammary gland and the method of the development of cysts in the only other gland that with the mammæ is subject to periodic evolution and involution, the ovaries, we find much to support such an hypothesis.

In the restricted neoplastic sense in which cysts are here defined, it will be remembered that the cyst is not merely a circumscribed collection of fluid or semi-fluid matter, but a secreting organ, in the construction of which epithelium or endothelium, according to its blastodermic genesis, occupies a determining position. Now, holding to the law that as yet has found no exception, of the permanence of embryonic tissue genesis, we must conclude, that epithelial cysts can arise only from epithelial cells, and that cysts of the mammary gland, which organ is chiefly composed of connective and epithelial tissue, with the comparatively slight development of endothelium in the vascular walls and lymphatic ducts, have their origin in the epithelium of that organ.

In the normal condition, the epithelial cells of the mammary gland are confined within the limiting membrane of the secreting tubes; in an abnormal condition, they pass beyond their physiological limit into the connective tissue, having penetrated the duct walls. In the development of the gland at puberty, and I think under an undue constructive as well as functional activity during its periodic evolution, the secreting surface is further increased by epithelial buds projecting from the lacteal tubes into the

connective tissue stroma. These buds, by a process of cell proliferation, augment in size, and finally become lacteal acini and ducts. Or, pursuing a different course, the communication with the primitive duct is lost by pressure or over-crowding of the new cells, and henceforth the would-be duct becomes an independent spherical body in the connective tissue of the gland ; a body with the inheritance of a secreting function, an adventitious, ductless gland. Let us now glance at the history of the ovaries. We have seen that up to a certain point the formation of cysts, *de novo*, in the mammary gland, is in accordance with the physiological development of the organ. A similar process takes place in the ovary, that results in the formation of the Graafian follicles, with their contained ovules. "The epithelium on the surface of the ovary sends into the stroma of that organ solid epithelial buds, which proliferate there and become isolated, ultimately forming the Graafian follicles, which are simply physiological cysts developed from the germinating epithelium covering the ovary." (Cornel and Ranvier). In a strict sense, the ovary is a closed gland ; in a less restricted sense, the Fallopian tube is the ovarian duct, and the ovarian cysts discharge their contents through that channel. The pathological process in the mammæ finds its analogue in the physiological process in the ovary, up to the point at which the latter discharges its cyst contents. The mammary cyst, having no outlet, increases to enormous proportions.

The development *de novo* of cysts in the mammæ may have still another genesis. Embryonic cells that have remained over from the construction of the organ —embryonic hypothesis of Cohnheim—are capable under the proper stimulus, of proliferating, and in their center, undergoing a spurious and imperfect secretion ; or a single cell, by vacuolation and endogenous cell formation, may give rise to a hollow organ, having some of the characteristics of a gland, an organ that may be classed with cysts.

Neither clinically nor anatomically is it possible to distinguish cysts of the mammary gland upon a knowledge of

their genesis; and much that has been said of the different methods of cyst formation it must be confessed is hypothetical; but the hypothesis is synthetic, and rests upon well ascertained biological data.

Looking to the genesis of cysts, there seems to be no reason for placing proliferous mammary cysts in a separate division from the simple cysts. The first formation in both cases is probably always the same epithelium lined sac. Later in the history of proliferating cysts this same epithelium expends its energy in construction, rather than destruction, of its cells, in characteristic multiplication of its cells, and not retrogressive softening, or loss of the organic unit. We can not say that the impulse to a departure from the secreting function of glandular epithelium, which converts a simple into a proliferous cyst, antedates the first changes taken in that direction; it seems more probable that we are to look upon this proliferation of epithelial cells within the cyst wall, as allied to the changes that precede the graver forms of epithelial neoplasms; as a mild constructive force, and not necessarily a part of the primary histogenetic error, but something acquired.

If there is to be a separate division for proliferous and compound cysts, it would be a more scientific classification to regard them as originating, considering the constructive power possessed by the *de novo* cysts and those that develop from gemmules or from buds, in one of these cyst forms; for both exhibit in a marked degree the constructive, in excess of the functional, activity.

From this proliferating epithelium, daughter cysts, or a solid mass of epithelium, is formed, between the cells of which a more or less extensive vascular system is developed, the canals of which do not in every instance possess a distinct wall. The intra-cystic growth increasing beyond the capacity of the cyst wall, breaks through its envelope and protrudes from a fistulous opening upon the skin, in the form of profusely-bleeding, very soft granulations, that are easily broken down, and quickly renewed after their removal.

The axillary glands do not always escape, neither are they constantly involved in the morbid process. But the appearance of the growth and its histology, showing an abortive attempt toward the development of gland tissue, are features that suggest placing proliferous mammary cysts in the same category with adenoma and carcinoma ; that would define them as a mild expression of a like neoplastic histogenesis.

Mammary cysts occur most frequently in young prolific married women, while the lacteal glands are in their period of greatest functional activity. They are usually of slow growth at first, but may suddenly begin to grow, and in a comparatively short time acquire an enormous size.

Their diagnosis, especially when the intra-cystic substance is more or less solid, is sometimes extremely difficult, and may require aspiration to determine ; much will depend upon the history of development, the absence of any evidence of secondary deposits, and the feeling of fluctuation that can sometimes be detected.

Treatment.—The treatment of mammary cysts, is removal. When the diagnosis is certain, puncture of the cyst or cysts, if they are multiple, is to be avoided ; it somewhat complicates the operation for removal of the breast, and serves no good purpose. The entire breast should be removed, unless it can be ascertained that there is only a single cyst. This can be maintained with reasonable assurance when the cyst is large, but when not large, or when there are two or three cysts, it may safely be concluded that this number does not represent all the cysts present, and to insure against the development of other, but at that time smaller cysts, it is well to remove the entire gland.

I am cognizant of only one medicine that has been known to affect cysts, *kali bromatum.* I have had no experience with its use in such neoplasms, having found the knife to accomplish all that was desirable in the way of a cure.

CHAPTER V.

DISEASES OF THE MALE BREAST.

The male mammary gland corresponds physiologically and histologically to the undeveloped female organ, and also to the extreme expression of its involution. In these two phases, therefore, we are to look for the genesis of the pathology of the male breast.

While the male organ has been known to assume the office of the female breast, and is sometimes found quite well developed without performing lactation, it is plain that such cases can not be considered when treating of the characteristics of the organs as they appear modified by sexual requirements, and hence it may be said that the distinctive male breast has no period of activity ; it remains throughout life a rudimentary organ, without apparent use, and subject neither to the laws of development, nor to those of growth. It thus becomes evident that for the pathology of the male breast there must exist causes that differ in some essentials from the causes that we have learned to look upon as chief in the ætiology of the female breast pathology. For if the male breast is exempt from all those changes of evolution and involution that make up the histology of the female organ, neither spurious irritation, nor vacuolated epithelial cells can enter into its pathology.

There being no functional activity, for I regard the normal male gland as entirely quiescent, the genesis of the occasional neoplasms—only neoplasms are found in the male breast—will reside, either in the predisposition that rudimentary parts, parts that seem to be left over during embryonic development, show to disease ; or, and this I consider the most probable hypothesis, in an abnormal slight degree of functional activity of the gland. This seems to be especially tenable of the carcinomas that are sometimes found in the male breast between the fortieth and fiftieth years of age. The few cases examined leave no doubt that they were true epithelial neoplasms, and it does not appear improbable that the epithelial proliferation began

in an excitation of the otherwise scarcely to be recognized epithelial cells.

Cysts, sarcomata, and fibromata have been found in the male breast, but they are even more rare than epithelioma, in the form of scirrhus. They belong to the corresponding periods of life at which the neoplasms develop in the female organ, and do not differ in any particular, save possibly in one, that they are less malignant and grow with less rapidity.

The treatment is the same as that advised for neoplasms of the female breast.

CHAPTER VI.

AMPUTATION OF THE BREAST.

A. The Question of Operating.

The presence of a tumor in the breast gives rise to the question, is it advisable to operate for its removal? Our decision will rest principally upon these considerations:

a. Does, or may, the tumor interfere with the performance of the function of the mammary gland?

b. Is the tumor likely to increase in size by its own inherent powers of growth; or may it receive an impulse to grow, in the functional activity of the organ in which it is situated? This consideration will apply to tumors that develop before and during the reproductive period.

c. Does the tumor, without being itself malignant, form a sufficient departure from health, upon which ultimately to graft a malignant neoplasm?

d. Is the neoplasm of such a nature as to form when active, a center for the infection of distant parts?

e. Will the neoplasm return after removal?

f. Will the removal of the mammary neoplasm be followed by the increased development of similar neoplasms in internal organs?

In general, it seems advisable to remove from the system

any unnecessary addition to it, any independent growth that draws upon the organism for support; but it is at once evident that the question is quite a complicated one.

The surroundings of the patient are of little importance in deciding for or against an operation. The wound made is small and superficial, and with even ordinary hygiene, and antiseptic precautions,—cleanliness,—the danger of septic poisoning is slight.

The first thing to establish is a correct diagnosis. If for example, there is presented for treatment a simple uncomplicated fibroma in a patient under forty-five years of age, whose health is good; on the one side is found a possibility of retrogressive metamorphosis, on the other the remote chance that when the mammary function begins to fold up and its vascular supply is reduced to a minimum, the neoplasm, like uterine fibromata when ovarian activity ceases, may atrophy, and finally disappear. The balance between these questions is unequal, favoring the first issue, and therefore, other things being equal, it is better to act upon the aggressive, and remove the neoplasm.

Interference with the functional activity of the mammary gland, as in hypertrophy, would be favorable to an operation, if by removing the growth the function could be restored; this could only in rare instances be expected to follow such treatment.

The principal issue will be found to center about the question, will the neoplasm be repeated in a more malignant form after an operation, or will it invade internal organs with more certainty than if not interfered with? Neoplasms that come within the definition named, represent different degrees of malignancy, and in treating them it must be remembered that at least at present the chances are against a cure.

The case is one of sarcoma, which even at an early period is probably multiple, and which forms metastatic nodules through the medium of the vascular canals. The mammary neoplasm rarely proves fatal, and the infectious quality of any single sarcoma is probably low, but the internal nodules, as of the lungs, seem to grow more rapidly

after the removal of the mammary tumor. In this case, unless urgently called for by local degenerations, an operation would probably shorten life.

In the progressively softening neoplasms an operation is also of questionable propriety ; but as the diagnosis of this characteristic depends upon the results of an operation, the only rule that can be given is, if the returning growth shows a more embryonic structure than the one removed, the operation should not be repeated.

A neoplasm of the breast viewed as a center of infection should receive but one treatment,—removal. Of course the results of an operation will be more favorable as the growth is in its early stages, before the activity which precedes the migration of its diseased cells, but even after infection has taken place it is wise to remove at least one source of disease. We are here dealing with epithelial neoplasms, a class of pathological new formations, the local degeneration of which bears a part with its multiplication in other organs, in proving antagonistic to life. By removing all of the morbid cell life that we can, we diminish by so much the force of contamination.

From the obscurity that surrounds the early stages of carcinoma, and the difficulty of establishing a clear diagnosis between the epithelial neoplasms and those of connective-tissue origin, notably the firm fibromata ; and because of the comparatively rare recurrence of the latter, and the almost certainty with which, after the former neoplasms begin to grow, they multiply,—become centers of infection, —it is advisable, unless the growth is known to be absolutely benign, as a sarcoma, to operate. While still a local histogenesis, carcinoma may be eradicated ; when it becomes a general disorder, and the entire organism is depraved, we can only hope to arrest the disease and palliate suffering.

The age of the patient will enter as an important factor, in the question of operating upon mammary neoplasms. There can be no doubt that Sir James Paget is right when he says that "after two or three years old, the increase of age is attended with a proportionate increase of liability to death and other ill consequences of operations." In old age, the risks have

reached their maximum ; unfortunately the most malignant neoplasms with which pathology is concerned belong to the declining period of life, and hence the removal of a carcinoma of the breast is almost of necessity attended by the additional risks that pertain to physical decay.

But we must not fall into the error of allowing the number of years in every case to mark the measure of a patient's life, or in fact her age. The quality of her life, the proportion that has been maintained between waste and repair, will more accurately than the number of her years, indicate the physiological period that has been reached.

After the fiftieth year, the surgical risks begin to increase ten-fold. And this for two reasons; *first*, there is a greater likelihood after that age of organic diseases of the circulation and kidneys being present; *second*, the sluggishness of the circulation predisposes to the formation of emboli, and the recuperative power being low, shock is illy borne, and slowly recovered from.

In general, therefore, an operation of any magnitude, as the removal of the breast together with the contents of the axilla, should not be performed before carefully examining the patient for some organic disease, and setting against the probable results of non-interference, the increased risk to life that the age of the patient is almost certain to bring. I am, however, inclined to consider the apparent age of the patient of more importance than the number of years she has lived. If there is an elasticity of fiber, a youthful energy, an activity of mind and body, even though the patient is at an advanced age, the chances are good for an operation, provided this is not attended with the loss of much blood. If on the other hand the fiber is lax, and constant weariness complained of, with slowness of digestion, in a patient under fifty years of age, the chances for a successful operation are not good, and operative interference would be justifiable only as an extreme measure, that, in its most favorable aspect, offers the possibility of prolonging life with relief from suffering, and in its most unfavorable aspect, but slightly anticipates the natural fatal issue.

B. The Operation.

The entire mammary gland may be removed, or only that portion containing the neoplasm. The steps of the operation are essentially the same in both cases, but differ chiefly in the extent of the incision made, and the quantity of tissue removed.

The operation may be performed with the knife; the scissors; an elastic ligature; or with escharotics. The knife is to be preferred before all other instruments. The methods of operating with scissors, the ligature, or escharotics, are given, to meet any remote requirement for operating upon the breast.

a. *The Operation with the Knife.*

It will be found convenient to have four assistants. The first to take the entire charge of the anæsthetic; the second to take charge of the sponges; the third to take charge of the instruments, and assist in controlling hemorrhage; the fourth to take charge of the arm on the affected side, holding it in the position required, and if necessary, to make tense the covering of the breast in opposition to the left hand of the surgeon. The operation can be performed with only one assistant to administer the anæsthetic, indeed a surgeon should be able to meet the necessity of acting as his own assistant, but it will be found to facilitate the operation, and to relieve the operator of unnecessary care, to have the four assistants in the order named.

For the past three years, I have almost exclusively used chloroform as an anæsthetic in my practice, and have found no reason to regret the choice. If I am not quite certain of the experience of the assistant who administers the anæsthetic, I give the preference to ether, for the reason that the use of chloroform requires more care, and more attention, than does the use of ether; its effects are accumulative in a high degree, and unless the respiration, which is the principal function to observe, not the circulation, in giving chloroform, is carefully watched, a dangerons quantity of chloroform may be taken before the surgeon is aware of the patient's condition.

In operations like those upon the breast, where anæsthetic effects are required for so short a time, it is not necessary to give morphine before the chloroform, unless the patient is very much excited.

There should always be at hand a bottle of *amyl nitrate* to use if the heart and lungs cease to act. Sylvester's method of artificial respiration I have found to be the simplest and most effective method of restoring the function of the lungs.

The patient being anæsthetized, is placed upon a table of ordinary height. This can generally be procured, even in the most humble dwellings, and by bringing the patient in a position convenient for the surgeon, greatly facilitates the operation ; or an army cot, with two or three thick mattresses, will answer equally well. The side to be operated on is slightly raised, and supported upon a pillow, and the breast turned toward the operator ; at the same time the corresponding arm is carried slightly upward and backward ; or if the surgeon can use both hands with equal facility, he may find it convenient to stand at the head of the patient.

The method formerly pursued of encircling the chest above and below the breast with strips of adhesive plaster, to prevent hemorrhage, is rather a clumsy manoeuvre, for the same object is much better attained by pressure upon the subclavian artery, from which are given off the axillary, intercostal and internal mammary arteries. But as hemorrhage is generally slight, even this precaution is not necessary ; it will be sufficient to secure each bleeding vessel as it is severed.

There is not much choice in the selection of instruments. A large, strong scalpel or straight knife are equally useful, though the curve of the scalpel, is perhaps always preferable when making a large, deep incision.

The shape and direction of the incision will depend upon the requirements of individual cases, but either the semilunar incision of M. Velpeau, or the more frequently used elliptical incision, will be found advantageous in the major-

ity of cases, the part to be removed being included within the shortest axis of the figure.

It is more convenient to make the lower incision first; and this is done by carrying the knife down to the pectoral muscle, through the entire length of the line. The extent of this incision may seem unnecessary, but remembering the direction given by the late Mr. Moore, that the operation for the removal of a mammary tumor should be so conducted as to leave no part of the neoplasm visible, the incisions passing through entirely healthy tissue, the extent of the incision will not only insure a more complete removal of the central mass and surrounding fat, but will also be found the most convenient method of gaining access to the pectoral and serratus magnus muscles, beneath, and at the lower border of which lie the pectoral lymphatic glands, bodies that are generally the seat of secondary nodules, when these occur in connection with mammary neoplasms; bodies that should be removed, even when not implicated in the morbid process.

After making the upper incision, which begins at that angle of the lower incision furthest removed from the surgeon, and is so directed, as is also the first incision, that between it and the outer border of the growth there shall be at least two or three inches, the gland, fat, and connective tissue are dissected from the pectoral muscle with the finger, the handle of the knife, or the periosteal elevator. The importance of removing all adipose tissue connected with the breast can not be over-estimated, for the evolutionary relations between the fat bodies and the development of the mammary glands, are suggested by the clinical observation that malignant diseases are most liable to recur in fat subjects, and in locations in which fat is most plentifully found. Search for out-lying lobes of the gland, which are generally found toward the axilla, and implicated lymphatics, requires much care and gentleness; care lest some should be overlooked, and gentleness lest undue injury, and hence inflammation, is thereby inflicted; for the former practice of pulling down the axillary glands through the pectoral incision, and then cutting

them off, may cause severe hemorrhage,—for the diseased lymphatics are usually in close relation with the axillary vein and its branches,—and be followed by inflammation of the lymphatic trunks. It is much safer to extend the incision so as to remove directly all such diseased structures. If the growth to be removed is attached to the pectoral muscle, this also should be dissected out, and each artery carefully ligated after the amputation is completed; for malignant growths of the mammæ extend toward the surface, before invading the deeper structures and lymphatics; possibly the disease can be arrested, if the operation is carried beyond the boundary of the invaded tissues.

Any hemorrhage that may follow either the removal of lymphatics, or dissection necessary to remove the gland, that can not be easily controlled with torsion or a ligature, may be treated with Paquelin's cautery, which should always be ready for use on the operating tray.

For removing a healthy adventitious mamma, the operation is essentially the same, with the exception that the object is to remove the secreting structure only, and not the lymphatics, nor the surrounding tissue; hence such a figure may be described by the incisions as shall include the nipple, and afford sufficient space to dissect out the gland.

When it is thought best to allow any portion of the gland to remain, the nipple should if possible be preserved. It would perhaps be the best practice to remove the entire structure if this can not be done, especially if the operation is performed before menstruation ceases; for if any part of the gland remains, and secretion takes place, this having no outlet, is liable to accumulate, and by distending the surrounding tissue, gives rise to a false cyst, or the "cystic adenoid" tumor of Mr. Bryant. Unless the hemorrhage is very profuse, it will not be necessary to secure the vessels before completing the operation.

Since the poisonous effects of carbolic acid have been shown to be so frequent, it has been sought to employ some other agent to render animal ligatures antiseptic; for this purpose chromic acid is used by Mr. Joseph Lister, with

very encouraging results. The ligatures so treated do not cause local irritation, and easily become organized or absorbed. But I have not found that they possess any special advantages over the carbolized ligatures, which certainly do not contain a sufficient quantity of phenol to render them poisonous, and are strong and pliable. The tendon ligature of Mr. Callendar is rather heavy, and not as easily managed for small vessels as those made of cat-gut, or the aorta of the ox. The ligatures should be cut short, and left in the wound.

If there is any reason to suspect that the axillary glands are involved, or even that the neoplasm is of such a nature as to offer a remote possibility that they may become the seat of secondary nodules, the entire axillary region should be cleaned out, and all the lymphatic glands and axillary fat removed. This is best accomplished by following the directions of Professor Volkmann. The incision is made through the skin and the fascia, parallel to the latissimus dorsi, which muscle is exposed. The dissection is then performed with scissors, until the axillary vein is exposed, when the glands with their fat can readily be removed.

I would again emphasize the necessity of stopping all oozing, and removing all clots from the wound before it is closed. Attention to these particulars will greatly aid the healing process. I have not found the best results to follow washing the cavity with an antiseptic, in the majority of instances I am led to believe such practice will be harmful. When the wound is healthy, it is sufficient to remove all accumulation, and even when the neoplasm operated upon is of a malignant nature there is no apparent advantage to be gained from the use of any medicinal wash; the principal point belonging to this stage of the operation is to stop oozing, and remove all clots.

The thoroughness with which drainage is accomplished will greatly aid to bring about a successful amputation of the breast. One of two methods of drainage will be found to meet the requirements of most cases.

Neuber, of Kiel, has proposed a method of drainage by

means of "canalization," that possesses some advantages over other systems.

Neuber's method does away with drainage tubes, and is divided into *shallow canalization*, and *deep canalization.* Shallow canalization is adapted to the drainage of extensive subcutaneous cavities, where the flaps are not very thick, and consists in making with a peculiar punch devised by Neuber, an instrument that resembles a common leather punch—the latter will answer the purpose very well—a number of holes (the number will depend upon the extent of surface to be drained) through the skin of the most dependent portion of the flap. The small pieces of subcutaneous fat that protrude through the holes so made, must be drawn out and cut off with curved scissors. These openings heal readily, but not before the cavity has healed.

The objection to this method is that at least the lower flap is constantly more or less bathed with the discharge from the wound, it being impossible to carry the discharge away through one canal. The dressing therefore is always wet, and this circumstance may render frequent changing of the dressing necessary, a practice to be avoided as much as possible.

Neuber's *deep canalization* is designed to facilitate drainage from a deep wound. The skin is detached from either side of the wound, and after being made sufficiently movable, is turned in and stitched to the bottom of the cavity with cat-gut sutures. The walls of the cavity are in this way brought and held in contact, and the funnel of skin remains a permanent drain. If the object is only to afford free exit for the discharge from the wound, deep canalization leaves little to be desired, but if the appearance of the breast after healing is completed is to be considered, it must be confessed that this method of drainage is open to objection. The remaining scar is very large and deep, and becoming adherent to the underlying structures, produces considerable deformity, certainly more marked than that resulting from other methods of drainage.

I still continue partial to the method of effecting drain-

age by means of drainage tubes, absorbable, or made of rubber. With the use of absorbable drainage tubes union by first intention is almost certain to follow, but very excellent results are obtained, and obtainable, from the perforated rubber tube. Much, however, depends upon the method of its use. To effect perfect drainage with the rubber tube, the tube should occupy the bottom of the cavity, and an end project from each end of the incision, the superficial space between being secured with wire sutures. This method is of special service when the axilla is opened.

The dressing of the wound is a matter upon which very different opinions are held. All methods have for their object healing by first intention, but especially is this desirable when the operation has been for the removal of a malignant disease; for the arrest of cellular development which constitutes suppuration, is, from the unformed type of the cell bodies, a condition well adapted to precede the development of those histogenic phenomena that produce local degeneration.

The dressings for wounds recommended only a few years ago, now seem very clumsy, and are calculated to favor the very condition which at present it is sought to avoid. Their weight and imperviousness generate heat, and prevent the natural action of the skin. All modern methods of dressing wounds are based upon the belief that primary suppuration, pyæmia, and septicæmia have their origin in certain definite animal and vegetable organ isms, that gain access to the blood through the open wound, and there act by setting up fermentation. Antiseptic surgery seeks to prevent, and to a great extent does prevent such organisms—bacteria—from falling upon the soil in which they develop; but that the system as now applied is imperfect, is beyond question. The ideal antiseptic is one that has no other effect than to control the growth and development of the septic organisms. It is not necessary to say that such an agent has not yet been found. Carbolic acid, that has done such good service in the hands of Mr. Lister and other European surgeons, does not meet the requirements for an antiseptic; for, from the cases where

its rigid use has failed to render the wound antiseptic, it is plain that there are some varieties of septic life that are not affected by phenol; and again, the poisonous action is so well defined, that even though the septic germs are destroyed, the patient may suffer fatally from the acid alone. Since the impetus given to antiseptic surgery by Mr. Lister,* almost every surgeon has used what he considered the best antiseptic, but each in its turn has been abandoned, and either some new substance substituted, or the system denounced as useless. Most of these dressings contain moisture, and this is a radical defect in any dressing that seeks to be antiseptic, for moisture favors the life and genesis of septic organisms. It is evident, therefore, that a dry dressing is an advance toward a more perfect application of the antiseptic principle than even the most carefully applied wet dressing could be. Probably absolute cleanliness and absolute health are the most perfect antiseptics, within certain limits, but while the former may be attained in favorable cases, the conditions that make any dressing necessary, are at least a local departure from health; are conditions at a particular spot that favor the growth of septic germs.

The best results will be obtained from dry dressings. Of these, when more than a simple layer of absorbent cotton is required, boracic acid is of especial value. This may be dusted over the wound, or on the cotton. The exceedingly unpleasant odor of iodoform is an objection to its use as a dressing, but its healing and antiseptic properties are of the first order, and where there is profuse suppuration it is indispensable. It may be applied in the form of a powder,

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* Within a few years Mr. Lister's methods of applying antiseptic surgery, and the antiseptic used have changed. He has greatly restricted the use of carbolic acid and substituted for it, eucalyptol, and more recently the bichloride of mercury. The eucalyptus oil is used undiluted in some cases, and in others, an ointment made after the following formula; *vaseline*, 2 2-3 parts; *parafine wax*, 1 1-3 parts; *eucalyptus oil*, 1 part. The eucalyptus is less irritating to the tissues than carbolic acid, and its use has not been followed by any of the dangerous symptoms that have been attributed to carbolic acid, though experiments show that the substition of *absolute phenol* in the place of commercial or crude carbolic acid, has been productive of less irritation, and poisonous effects.

one-third iodoform, and two-thirds starch, or bran, or sand; or an ointment may be used composed of,

℞. Iodoform ʒ i.
Simple cerate ℥ i.

or iodoform in the form of *hydrophile iodoform gauze*, as used in Billroth's clinic, is an excellent dressing; both of these are of especial advantage where there is any syphilitic taint.

The old ointment,

℞. Balsam of Peru ʒ ss.
Simple cerate ℥ i.

is a most useful dressing; also where there is much laceration of the parts,

℞. Calendula f ʒ i.
Simple cerate ℥ i.

But of all dressings, I prefer the sublimated absorbent cotton, and sublimated gauze—an excellent article of which is prepared by C. Am. Ende, of Hoboken, New Jersey. The dressing is dry, highly antiseptic, absorbent, and sufficiently elastic to allow equal pressure over the wound, all of which qualities contribute to make a perfect surgical dressing.

From the following procedure I have obtained the best results after amputation of the breast. During the operation no water is used, excepting that necessary to cleanse the sponge, and finally free the wound from clots, and this water is previously boiled, and made to contain corrosive sublimate in the proportion of 1–500. Before closing the wound, the dry sponge is pressed firmly into every part, to absorb all moisture. The axillary incision can usually be closed with sutures—silver—but if much tissue has been removed with the mamma, this part of the wound had better be left open, and allowed to heal by granulation, or it may be partially closed by deeply carried wire sutures. I prefer these to adhesive plaster, as being more cleanly. After the drainage tube is inserted—it will generally be sufficient to carry this into the axilla, the thoracic wound will not require drainage unless the flaps are very long and the cavity from which the tumor is removed correspondingly deep,—the line of the incision

and border of the wound are varnished thickly with the compound tincture of benzoin, which is impervious to moisture, and possesses the property of controlling local congestion. The free end of the drainage tube, which should reach two inches below the chest bandage that will complete the dressing, is laid in a quantity of marine lint, sufficient to absorb all discharge. This lint can be changed without disturbing the wound dressing. In contact with the wound is then placed a single thickness of sublimated gauze, that has been saturated with pure olive oil and corrosive sublimate 1–500. This will prevent the dressing from adhering to the granulating surface, should it become necessary to examine the wound. A pad of sublimated cotton, inclosed in sublimated gauze, that has been previously made two or three inches longer than the entire incision, and about five inches wide, is finally secured over the wound by means of a roller bandage that extends from the level of the ensiform cartilage, to the armpit, placed as tight as the patient can bear, without interfering with respiration. It is not necessary to include the arm in the chest bandage, unless the patient is very restless, when it will be found convenient to do so to insure quiet of the healing tissues.

Where there has been much mutilation of the parts, consequent upon deep dissection and removal of the axillary glands and part of the pectoral muscle, the local pain will be relieved by a dressing of *hypericum oil*, which may be substituted for the dry dressing. The pure article is somewhat difficult to procure, and as it is very easy to prepare, may be made by each surgeon for his own use. A bottle is half filled with the blossoms of the *hypericum medium perforatum.* To this an equal quantity of olive oil is added, and the whole allowed to stand in a sunny window for two or three months; by this time the oil will have acquired a reddish brown color, and is ready for use. If there is no considerable rise in temperature, or other indication that repair is not progressing, the wound may remain undisturbed for from six to ten days, and even longer if the dressing does not show that suppuration is taking place. Slight saturation of the

absorbent pad with discharge does not alone, call for its removal; a fresh piece of sublimated cotton may be placed over the spot, and the bandage reapplied. At the end of ten days the wound will be found healed, and the stitches may be removed. After this a simple dressing of sublimated oil will complete the cure.

A word in relation to the removal of drainage tubes. The principal fluid that they carry away is the serum that is poured out when hemorrhage has ceased, and which continues to flow for about forty-eight hours. As soon therefore as the tube becomes dry, in case the dryness is not caused by plugging of the tube with a clot—and this can be ascertained by passing a long probe into the tube—it should be removed, but this would leave no exit for the pus that has probably formed. It is a good rule to follow, that if, at the end of three days the tube remains dry, it should be removed. To do this it may be necessary to raise the dressing that covers the drainage tube, but generally the tube can be drawn out without disturbing the dressing.

The method to be selected for maintaining pressure over the amputated breast is a matter of some importance. The requirements to be met are firm equal pressure, of a degree sufficient to bring the walls of the cavity in opposition, and at the same time not to compress the drainage tube. A broad bandage, or a spiral bandage are equally useful, but either one is so irksome to some persons that it can not be worn without causing undue irritation. Adhesive straps are also useful, but they can not be altered without removal. I have found the following apparatus to meet the requirements where a bandage could not be applied.

A piece of canvas used for embroidering is cut with square corners, three inches larger in every direction, than the surface to be healed. The edges of this are rolled and sewed firmly, and on each side, at least three pieces of tape, six inches long, fastened. Strips of strong adhesive plaster (Man's mole-skin), three inches broad at one end, and two inches at the other, and ten inches long, are cut, of a number to correspond to the number of tapes on the piece of canvas. The small end of the adhesive plaster is then

folded upon itself, and a piece of tape six inches long is attached by sewing. The piece of cloth is then laid where it is desired that it shall remain, and the adhesive plaster applied to the chest in such a way that they shall spread from the border of the piece of cloth in rays, there being about three inches between the small end of the adhesive plaster and that border. The corresponding tapes are then tied. By this apparatus the pressure can be regulated as may be desired, and the wound exposed when necessary, by removing the piece of canvas.

A method has been proposed by Dr. T. Gaillard Thomas, for removing benign tumors of the breast without mutilation of the organ. The operation is thus performed: The patient standing erect, and the mamma being completely exposed, a semicircular line is drawn with pen and ink, exactly in the fold which is created by the fall of the organ upon the thorax. This line encircles the lower half of the breast at its junction with the trunk. As soon as it has dried the patient is anæsthetized, and with the bistoury, the skin and areolar tissues are cut through, the knife exactly following the ink line just mentioned, until the thoracic muscles are reached. From these the mamma is now dissected away until the line of dissection represents the chord of an arc, extending from extremity to extremity of the semicircular incision. The lower half of the mamma, which is now dissected off, is, after the ligation of all bleeding vessels, turned upward by an assistant, and laid upon the chest walls just below the clavicle. An incision is then made upon the tumor from underneath, by the bistoury, a pair of short vulsellum forceps firmly fixed into it, and while traction is made by these, its connections are snipped by scissors, the body of the tumor being closely adhered to in this process, and the growth is removed. All hemorrhage is then checked, and the breast is put back into its original position. The outer surface of the breast is thus uninjured. The lacteal apparatus is scarcely touched, and no perceptible mutilation of the parts remains after healing is completed.

b. Removal of the Breast with Scissors. It has been pro-

posed by Mr. W. Richardson, to remove the breast with scissors, cutting under ether spray. I am not aware that this method has been employed when anæsthesia has been produced by inhalation. But advantages must accrue from a method that will render unnecessary the use of narcotic vapors in surgery, and for this reason, more importance attaches to the local anæsthesia than to the special instrument with which Mr. Richardson operates. The freezing of the parts, however, which is the way he produces local anæsthesia, necessitates the use of scissors, for it would be almost impossible to divide the frozen tissues with a scalpel, but the scissors cut with the utmost facility. Mr. Richardson produces local anæsthesia, by first directing a spray of common ether on the parts, until they are thoroughly chilled; this is generally accomplished in about four minutes. A spray of the light fluid called anæsthetic ether, a compound of ether, of *sp. gr.* 720, with hydride of amyl, is substituted, the application being continued for a few minutes only, when the whole breast will be frozen hard.

The local anæsthetic, the *hydrochlorate of cocaine*, but recently introduced into ophthalmic surgery by Dr. Koller of Vienna, is probably of wider application than the discoverer of its anæsthetic properties at first believed. To produce complete local anæsthesia, it is only necessary to bring a solution of the alkaloid, generally 4 per cent. made with distilled water, in contact with the nerve trunk, or branches that supply the region that it is desired to render insensible. This can readily be effected by means of a hypodermic injection, and in the case of operations upon the breast, if the needle is introduced in the upper and outer quadrant of the gland, where it will be brought into relation with the principal nerve branches,—though probably any site would answer equally well,—from five to ten drops of the 4 per cent. solution will produce anæsthesia lasting about half an hour. The injection may be repeated at any time during the operation, if it is desired to continue the anæsthesia.

To avoid any irritating effect from the hypodermic injec-

tion, extreme caution should be observed in procuring the drug. That prepared by Merck, of Darmstadt is the best now in the market, but a very excellent article may be obtained of Parke, Davis & Co., of Detroit. The impurity to be guarded against is principally hydrochloric acid, sometimes used as a more rapid method of dissolving the alkaloid. The properly prepared four per cent. solution, should, when applied to the tongue, leave nothing more than a slightly furry sensation, and this only for a few minutes.

An incision with a scalpel being made at the outer margin of the part to be removed, a pair of slightly curved scissors are entered, and carried down to the deeper structure, thus forming the lower flap; the upper flap is dissected up in the same manner. The tumor is then grasped in the left hand, and with a pair of slightly curved scissors, all the connections with the surrounding tissues are severed. The ether spray should now be withdrawn, and the wound allowed to remain open a short time to ascertain if any vessels bleed during the reaction from freezing. If necessary, ligatures may be used to secure vessels. The subsequent treatment does not differ from that already indicated.

The operation, if properly performed, is painless. The patients operated upon by Mr. Richardson experienced only a sensation of chilliness upon the first application of the spray, but were not aware when the tumor was removed. This method would be safe, only where the neoplasm to be removed was known to be of the most benign nature, for where the tissues are frozen, it is impossible to carry on any careful exploratory dissection. I have no personal experience with its use, having been less willing to run the risk of leaving any removable center of disease, than to produce general anæsthesia.

c. The Elastic Ligature, or *Bloodless Method of Amputating the Breast.* The use of an elastic ligature as a means of removing tumors, was introduced into surgery by Prof. Dittel, of Vienna. The possibility of such an operation was suggested to him while

making a post-mortem examination of a young girl who died with "severe nervous symptoms." He discovered the hard rubber band of a hair net which she had worn day and night, for a month, deeply imbedded in the pericranial tissue, and in one place, that it had cut through the walls of the skull and was pressing upon the dura mater, which was in a state of active inflammation. This method of operating upon the breast was introduced into England by Sir Henry Thompson, who, on November 21, 1873, removed a fungous growth from the mammary gland of a woman, by passing two stout india rubber ligatures across and around the base of the breast after the manner about to be described.

The use of the elastic ligature has shared the fate of other novelties, and been abused. Professor Dittel has even amputated legs in this way. It is only a question of time when all things reach their equilibrium, and are judged by their true merits; and while the elastic ligature may be a most valuable instrument in the hands of the surgeon, it is questionable whether among the cases in which it may be advantageously used, is to be ranked amputation of the breast. It is difficult to conform one of the most elementary rules of surgery, viz., to perform an operation as speedily as is consistent with safety and thoroughness, and in such a manner as will entail the least possible suffering upon a patient, with its use in such cases.

In the case operated upon by Sir Henry Thompson it is probable that "the fungoid growth" could have been removed more scientifically by some other method, and it is difficult to perceive any advantage gained over the use of the knife. Chloroform was administered to the patient, the tumor did not come off until the tenth or twelfth day after applying the ligature, and during that time a sphacelated mass of tissues remained in contact with the absorbents of the thoracic region, and was so offensive that constant irrigation with carbolic acid was found inadequate to destroy the odor that arose from the decaying tissues. The most that can be said in favor of amputations performed with the elastic ligature is that they are bloodless, or nearly

so, and for this reason the method is a valuable adjunct to surgery ; but its use is in those operations which it may reasonably be expected will be followed by profuse hemorrhage that is difficult to control ; such operations upon the breast are very rare.

The following is the operation proposed by Professor Dittel and followed in all essentials by Sir Henry Thompson : " A piece of india rubber cord, about the size of a No. 4 catheter, is passed through the eye of a large curved needle set in a handle. Through the same eye a short piece of whipcord is passed. The breast is then gently drawn from the subjacent tissues, and the needle carrying the india rubber and the whipcord is made to transfix its base. When the point of the needle has emerged, the india-rubber band is cut in two, and the needle withdrawn, leaving the whipcord uncut. Each of the two india rubber bands are now made to encircle half of the mamma, and then tied tightly as in the operation for nævus. The operation, which is quite bloodless, is now complete. The constant pressure of the india rubber cords causes linear sloughing, and in nine or ten days the breast separates. It may be added that the whipcord is passed through with the india rubber cord, because the latter occasionally breaks after two or three days. Sometimes only one side of the breast is tied at the primary operation, the other half being left until the first has been completely cut through."

It will be observed that no cutaneous incision was made previous to applying the india rubber cord, but Sir Henry Thompson remarks that though he wished to perform this particular operation exactly according to the rules of Professor Dittel, he would in future prefer to make a slight groove in the skin, in which the india rubber ligature should lie. After the tissue has sloughed, the dressing of the wound does not differ from that after other operations upon the breast.

We have spoken somewhat at length upon this method of operating, for it has been indorsed by men justly renowned for their skill, and therefore deserves consideration, if not approval, at our hands.

d. Escharotics in operations upon the breast.—Perhaps the most primitive method of operating for the removal of a part from the body, is that which has for its object the reduction of local vitality by means of chemicals, or heat, and subsequent sloughing of the dead part. The dread of hemorrhage, and ignorance of the circulating system, recommended such means to early surgeons, and latterly, escharotics have become associated with the name of charlatan ; but for such a reason it would be unscientific to discard as useless this adjunct to surgery. It is, however, desirable that escharotics should be limited to their proper place and use in the healing art.

Any method that seeks to accomplish an end by other than direct means ; that removes the responsibility from the present to the future, however remote, is but temporizing with the problem of treatment, and, though it can not be doubted, often honestly pursued, is an illustration of devotion to some special theory, or of an unwillingness to assume the responsibility of prompt, and what may appear to be heroic, methods. In this way I am disposed to look upon the use of escharotics in operating upon the breast. What can be removed with the knife can not be reremoved better with escharotics, and when an operation must be performed, there is no advantage gained from the uncertain application of chemicals. I see no reason for believing, that if the disease is malignant, and has spread beyond the justifiable use of the scalpel, any chemical that may be used will reach the infected tissues, or prevent such from spreading ; and hence, while in occasional cases the timidity of the patient, or the general condition is such as to preclude the use of the knife for the removal of a mammary tumor, it seems but a waste of time, and of the strength of the patient, in the present advanced state of surgery, to resort to methods perfect in their day, but now obsolete.

The method that bears the name of its inventors, Drs. Marston and McLimont, contains the essentials of the escharotic treatment of tumors. The pamphlet in which their procedure is described is interesting more from the earnestness and honesty with which the authors seek to

maintain and establish their views, than from any scientific knowledge that may be acquired from its perusal.

After subjecting the patient to "a little preparatory training, chiefly dietetic," that she may not break down under the debilitating effects of the "enucleation process," a mixture of ice and salt is applied to the "cancerous" tumor—I am not aware that it has been employed against benign affection of the breast—to deaden the sensibility. The parts are then dried, and the tegumentary covering destroyed, by means of undiluted nitric acid. After washing the breast with cold water, a piece of lint, spread with a paste (composed of a strong decoction of *hydrastis root*, powdered *hydrastis*, chloride of zinc and flour) and stramonium ointment, is applied to the surface. This dressing is allowed to remain undisturbed for twenty-four hours, and upon its removal a hard, dry eschar will be found to have formed. Through this eschar "vertical incisions are made with a scalpel, to the depth of about $\frac{1}{20}$ of an inch, care being taken not to draw blood. The incisions should be parallel to one another, at a distance of about half an inch apart, and into each is inserted a thin slip of calico covered with the paste; on the whole a *light* compress should be applied, and kept in its place by a strip of adhesive plaster. The incisions are deepened, and the dressings removed usually every day, and this is continued until the paste has penetrated the entire mass of the tumor." The sphacelated mass generally comes away in about a fortnight, and the remaining wound is treated by "the daily application of a piece of cotton wool spread with *stramonium* ointment, as recommended by Dr. Fell." The constitutional treatment consists in the administration of *belladonna*, *amm. m.*, *arsenicum*, *aurum*, *carbo an.*, *cinchona*, &c.

The topical use of arsenic has long been in favor for the treatment of what the popular tongue calls cancers. This Dr. A. Marsden uses in the form of "Arsenical Mucilage,"

Arsenious acid,	ʒ i.
Mucilage,	℥ i.

but all such methods consider no individuality: they pro-

ceed upon the hypothesis that all men are cast in the same mold. If drugs are relied upon to effect a cure, they must be selected according to the indications for their use.

Sometimes an ulcerated surface will remain after amputation of the breast; this will in general be quickly healed by the use of Balsam of Peru ointment, or boracic ointment, or calendulated cerate. For reasons already given, we prefer to use the particular remedy in the form of an ointment rather than as a watery dressing. There has recently been introduced to my notice a preparation of palm oil, made by Edward S. Morris, of Philadelphia, that promises to be of service in this stage of the healing of wounds. The substance is very pure, and possesses considerable healing properties, at the same time that it allays superficial irritation. The oil, however, readily becomes rancid, and hence is liable to induce the growth of micro-organisms in the vicinity of healing surfaces. Generally no constitutional treatment will be necessary after amputation of the breast, but should conditions arise during the process of healing, these will almost always be met by either, silicea, or calc. sulph.

CHAPTER VII.

SPECIAL THERAPEUTICS.

Aconitum, lycortoneum. Swelling of the mammary gland.

Aconitum, napellus. Mammary glands lax and empty after labor. Mammæ hot and tense, with scanty milk. Milk fever with delirium, skin dry, absence of sweat. Thirst.

Æthusia cynapium. Swelling of the mammary gland. Piercing pains, with heat and redness. Vesicles filled with lymph, violent stinging in the mammæ. Great agitation.

Agaricus. Pustules on the breast, with red areola. Itching and burning. Piercing in the left mamma, descending obliquely as far as the navel, from the left

nipple outward. Nipples itch and burn. Twitching and jerking of muscles.

Agnus castus. Deficient secretion of milk in nursing women. A most despairing sadness.

Allium sativum. Swelling of both mammæ. Sensitive to touch. Dull red blotches between the mammæ, and around the nipple. Dull stitches in the RIGHT mamma. Mammæ swollen after weaning. Injurious to women who are nursing.

Alumen. Cancer of the mammæ. Sore, inflamed nipples. Indurations of the uterus, vagina very sensitive, and narrowed by swellings of various size. Copious leucorrhœa.

Alumina. Stitching pain in the LEFT breast in the morning. Very profuse leucorrhœa; constipation from dryness of the rectum. Weakness after the menses. Adapted to thin, dry subjects, and old persons.

Ammonium carb. The RIGHT breast is painful when touched. Stitches in the RIGHT breast. Menses premature, consisting of black clots, leucorrhœa, profuse and acrid. Chronic headache. The moment she falls asleep, she is roused by a feeling of suffocation. The later she goes to bed the less she can sleep.

Ammonium mur. Sensation of flea bites in the mammæ. Ovarian neuralgia.

Amygdalæ amaræ aqua. Stitches under the LEFT nipple.

Anagallis arvensis. Cancer of the mammæ.

Antherum muriatanum. Erysiphelatous swelling of the mammæ. Heat and pain. Inflammation and swelling, congestion. Indurations, and ulcerating tumors of the breast. Swelling of the axillary glands. Excoriation of the nipples. An excessive flow of milk. Breasts atrophied. A sensation of swelling of the ovaries. Fibroma of the uterus. Stitches like lightning in the uterus. Menstruation anticipates.

Apis. Redness of the breasts, with stinging pains; swelling and hardness of the breasts; spots like bee stings. Mental depression. Very sleepy. Scanty urine. No

thirst. No periodicity. Inverted nipples. Right ovary sensitive. Sexual desire increased. *Aggravated* by heat; *relieved* by the application of cold water.

Argentum nit. The RIGHT mammary gland toward the axilla is painful as if ulcerated, especially when touched; when stretching the arm away from the body, an oblong tumor is found in the breast. Tension of the axillary glands. Scirrhus mammæ. Nipples sore from nursing. Metamorphosis of tissue. Increased cheerfulness and a disposition to be loquacious. Pain during coition, followed by profuse bleeding. Uterine hæmorrhage. Ovarian irritation. *Metorrhagia in young widows.*

Armoracea sativa. Milk tastes and smells like horse radish.

Arnica montana. Hardness of the breast, traumatic erysipelas of the breasts, great sensitiveness of the breast; she fears that she will be touched by persons approaching the bed. The nipples are sore and excoriated, itching of the nipples. Nipples of a child swollen and tender. Drowsiness during the day; wakeful until two or three o'clock A. M. *Aggravated* in the evening, at night, and by motion. *Relieved*, by lying down.

Arsenicum alb. Burning pains, as if a hot iron were thrust into the breast. *Pains gradually increase until they reach their climax, and then as gradually decrease.* Skin dark, threatened gangrene; dryness of the mouth, with thirst for small quantities of cold water; water causes pain and distress in the stomach. Pulse irregular and weak; night sweats. Pain in the LEFT mamma, behind the nipple, extending to the hip. Diseases caused by sea bathing. Loss of strength with emaciation. *Aggravation* in the evening, after midnight, and by cold; *relieved* by warmth.

Arsenicum jodatum. Lumps in the mammæ, with ulcerated nipples. The tumors are sensitive to touch, and painful. Emaciation.

Arum triphyllum. Lumps deep in the left mamma. Soreness and pain, as if bruised, in the left mamma. Menstruation checked for two months.

Arundo mauritanica. Excessive flow of milk. Burning in the nipples. Increased sexual desire.

Asafœtida. Breasts very much swollen, as in the latter months of pregnancy, in a woman not pregnant. Discharge of milk. Said to dry the milk. Restores the wasted and drying up breast of milk.

Asclepias tuberosa. Sharp pains shooting from the LEFT nipple downward.

Asterias rubens. Slight eruption between the breasts. Dull aching. Lancinating pains in the mammæ, that deprive her of sleep. Drawing pain in the breast. Scirrhus. Nipples drawn in. Skin smooth and adherent. Ulceration and swelling of the LEFT breast. Breasts swollen and distended before menstruation. Induration of the left mamma. A feeling as if the breast were being drawn downward. Drawing pain toward the inner portion of the chest, from before backward, under the LEFT breast; this pain, which extends down the inner side of the arm to the end of the little finger, begins in the evening, and lasts until the following morning. The head feels hot, as if surrounded by hot air.

Aurum muriaticum. Carcinoma of the uterus and mammæ. Enormous distension of the ovaries.

Aurum sulphuratum. Swelling of the breasts, which are painful to touch. Cracks in the nipples. Menses irregular. Leucorrhœa aggravated in the morning.

Badiaga. Carcinoma mammæ. From its profound action on glands, should be of service in tumors of the mammæ, when not attended with marked inflammation.

Baryta carb. Tearing and lancinating in the mammary glands; menses very scanty; can not lie on the LEFT side; chronic swelling of the tonsils. *Aggravated* by motion, and the open air.

Benzoic acid. Burning in the nipple. Sensation of swelling in the mammary gland. Long lasting lochia.

Berberis vulg. Stitching pain in the mammæ, passing from within outward between the mammary gland and the walls of the chest, more violent behind the LEFT nipple; sensations as if the breast were swollen; vagina very sensi-

tive; soreness and burning, especially near the labia; many urinary troubles; usually *aggravated* in the afternoon.

Belladonna. Hardness and swelling of the RIGHT breast; breasts heavy and bright red, very sensitive when touched; nipples sore at every menstruation; red streaks spreading in radii, from the nipple along the course of the milk ducts. Pains shooting and tearing, spreading in radii; throbbing and stitching pains; pains come and go suddenly. Stupid feeling; constant drowsiness; cephalgia with congestion to the head; dry burning heat; pulse strong and quick; mouth dry, with little thirst; *aggravated* at 3 P.M.

Borax. Contractive pain in the LEFT breast, when the child nurses from the RIGHT. Aphthous nipples, bleeding easily. Skin difficult to heal. Aphthæ on the tongue and mouth, that bleed when eating. Galactorrhœa, milk too copious and thick, curdling soon after flowing from the breast. Menses early and profuse; urine fetid; desire for milk. *Aggravated* in damp weather.

Bromine. Hard tumor in the breast, with adhesions, periodical lancinating pains, especially at night. *Aggravated* by pressure. Amenorrhœa. Headache after taking milk; can not lie on the left side. Swelling and induration of glands. Scirrhus; grayish, earthy complexion. Light hair and blue eyes. Great depression of spirits. *Aggravated* from evening until midnight.

Bryonia. Lumps in the RIGHT breast; tension and shooting pains in the tumor. Breasts heavy; swelling not red; hardness of the breasts; diminished secretions of milk. Pain in the head; dizziness when rising, or when sitting; chill, followed by fever. Constipation, stools as if burned; thirst for large quantities, but infrequent; puerperal fever. *Aggravated* before midnight, toward 9 P.M. by lying on the healthy side; *relieved* by cold, and when lying on the healthy side.

Bufo. Inflammatory swelling of the breasts. Erysipelas of the breasts. Small knobby indurations. Large abscesses and sinuses. Milk vitiated and mixed with blood. Burning, lancinating, gnawing pains in the mammary and

axillary glands. Polypus of the uterus. Swelling and sensitiveness of the ovaries. Malignant tumors. Progressive emaciation. Swelling of glands; milk leg.

Cactus grand. Hard tumor in the RIGHT mamma, subsiding during lactation. Mastitis; ovaritis.

Cadmium sulphuratum. Erysipelas of the breasts. Inflammation of the nipples.

Calcarea carb. Pain as of ecchymosis of the breast; swelling and heat of the RIGHT mamma, which is painful to touch. Breasts distended and hard, but not red. Discharge of milk from the breast of an infant. She is cold, and there seems to be an absence of sufficient vitality to bring the milk forward. Soreness of the nipples, swelling and inflammation of the LEFT nipple, with stitches. Affections at the commencement of the new moon. Rush of blood to the head. Depression of spirits with foreboding of some misfortune. Out of breath from going up stairs, very sensitive to the least cold air. She feels as if she had on cold, wet stockings. Aching in the vagina. Anxious toward evening. Menses too early and profuse, the discharge is *per saltum.* Breasts painful at the time that she should menstruate. Nipples painful during miscarriage. Cannot drink milk; can bear nothing tight about the abdomen; swelling of the cervical glands. Glandular hypertrophy. *Aggravated* by touch, by any current of air, either warm or cold, and by excitement.

Calcarea fluorica. Hard knots in the breast. Indurated glands of stony hardness.

Calcarea iodata. Hard stationary scirrhus of the mammary gland. A remedy that has proved of the greatest value in relieving the pain of carcinoma.

Calcarea ox. has more than any other remedy relieved the terrible pains of ulcerated carcinoma. Carcinoma of the LEFT breast with intense agonizing pains.

Calcarea phosphorica. The milk is at first alkaline, changing to neutral or acid. Mammæ sore to touch, and large, as during pregnancy. Burning and pain in mammæ. Nipples sore. Nymphomania, with insatiable desire, particularly before the catamenia. Increased leucorrhœa.

Calcarea sulphurica. Mastitis when pus begins to form, or to prevent suppuration.

Calendula. Excoriated and cracked nipples. Serves to stimulate the proliferation of white blood corpuscles and connective tissue cells. Promotes granulations. Useful locally, 1–100, and internally.

Camphora. Fine stinging in the nipples. Suppuration of the mammæ. Puerperal mania,—constantly bares the breast. Abortions.

Cantharides. Mammæ painful, with dysuria.

Carboneum sulphuratum. Enlargement of the axillary glands from an indolent tumor of the mammæ, with a decided rheumatic diathesis. Itching stitches in the RIGHT nipple. Almost entire obliteration of the ovaries.

Carbo animalis. Breasts swollen, and erysipelatous, particularly during confinement; painful nodosities in the breast; scirrhus; burning, tearing pains; induration of the axillary glands; induration of the mammæ during menstruation; menstruation very exhausting; lochia long continued, and excoriating; bitter taste in the mouth. *Aggravated* by pressure, in the evening, and when lying on the right side.

Carbo vegetabilis. Scirrhus of the breast; erysipelatous inflammation; excessive prostration; acrid morning sweat; foulness of all the secretions; desire for fresh air; excessive accumulation of flatus in the stomach, and upper intestines; liability to take cold; menses premature and copious; itching, burning and excoriation of the vulva. *Aggravated* during warm, damp weather, after eating, and in the morning.

Carduus marianus. Simple inflammation of the breasts.

Carlsbad. Breasts painful; frequent transient stitches; menstruation more profuse, and lasting longer than usual. Difficult menstruation.

Castor equorum. Sore, cracked nipples in nursing women; excessively tender, can scarcely bear the clothing; neglected cases, when the nipple is almost hanging off. Swelling of both mammæ, especially the LEFT. Violent internal itching of the mammæ. Areola red. Mammæ so

painful on descending the stairs that they feel as if they would fall off.

Castoreum. Sudden twinging in both breasts, with chilliness, frequently intermitting at 8 P. M. Mastitis, with fever in the evening.

Causticum. The nipples are excoriated, cracked, and surrounded by tetters; deficient secretion of milk; milk almost disappears in consequence of fatigue; profuse leucorrhœa; stiffness of the back; pain in the coxo-femoral joint when coughing; great melancholy, especially during menstruation; menses early and profuse. *Aggravated* by drinking coffee, in the open air, in the evening, and while lying on the painless side.

Cedron. Swollen mammæ, in married women.

Chamomilla. Breasts inflamed, swollen and painful when touched. Erysipelas of the breasts, with soreness of the nipples; induration of the breasts, with burning lancinating pains; scirrhus; suppression of milk; nursing is very painful. Irritable and impatient. Pains unendurable. It is difficult to speak pleasantly. Free sweat after eating or drinking; alternations of heat and cold; burning in the vagina; yellow smarting leucorrhœa; *aggravated* before midnight, by lying on the painless side; by the warmth of the bed, and during menstruation. Pain *relieved* after sweating.

Chimaphila umbellata. Atrophy of the breasts. Tumor of the mammæ. Scirrhus of the mammæ. Ulcers with irregular edges, sloughing, and with fetid pus. Axillary glands enlarged; hectic fever; urinary troubles.

Cicuta virosa. Burning pains in the nipple. Shivering, with a desire for the fire. Involuntary starting of the limbs during the menses; menses are delayed, tearing in the coccyx. In lacteal obstruction, can be used in the fluid extract, externally.

Cimicifuga racemosa. Pricking sensation in both mammæ; aching, wavy pains in the left mamma; great melancholy; abortion in the early months of pregnancy; chills and pricking in the mammæ during miscarriage; menstruation suppressed by a cold; restlessness in the afternoon;

lameness of the back ; sensation as if the top of the head would fly off ; troubles caused by grief ; pains paroxysmal. Pricking in both mammæ with chilliness.

Cistus canadensis. Inflammation from obstruction of the lacteal ducts ; induration of LEFT mammæ. Scrofulous habit, dryness and heat in the mouth ; she is sensitive to the cold air, coldness of the tongue and throat.

Clematis erecta. Swelling and induration of the breasts ; scirrhus of the breasts ; fungous hæmatodes ; vibrations through the whole body; sadness, with apprehensive feeling; pale and sickly ; stitches in the shoulders ; she dislikes to be uncovered when perspiring ; nocturnal paroxysms ; *Aggravated* in cold weather, and during the increasing moon.

Comocladia. Acute, sharp, burning pain in the LEFT mammary gland one inch above the nipple ; increasing in intensity, the pain goes to the RIGHT side, and down the right arm. Pain passing from the mammary gland, close to the spleen. Sloughing ulcer in the RIGHT breast. When rising from bed, every thing seems dark. Violent itching of the skin. *Relieved* by motion and in the open air.

Conium maculatum. Scirrhus following contusion ; inflammation, with stitching pains ; inflammation of scirrhus ; itching of the nipples, with red scaly skin. The mammæ swell, and become tender before menstruation. Skin dark red, swelling and hardness, with dull, aching pains. Stitches in the mammæ during menses. Menorrhagia. Complete atrophy of the breasts, they are flaccid, and hang like bags. Flaccid and shriveled breasts, with increased sexual desire. Amenorrhœa, sleeplessness, with drooping of the eye-lids in the evening. Vertigo when looking backwards, and when turning in bed. She dislikes society, but dreads being alone. Great exhaustion. Burning, acrid and pungent leucorrhœa. *Aggravated* in the morning, in the evening, and in cold weather. *Relieved* when walking, and after becoming warm.

Cotyledon u. Dull pain in the left nipple. Dull, broad pains from the left nipple to the front of the left scapula ;

dull pain in a small spot under the left nipple; soreness of the right breast; constant pains in the left breast, sometimes acute. Recurring dull pain without cause. Much pain in the abdomen. Profuse urine. Various pains in the chest. *Aggravated* by walking, in the evening, when riding, and by pressure.

Crotalus. Ulcerated carcinoma, which is a dark red, with streaks of blood over its base. Hemorrhage from different parts of the body. The milk becomes a deadly poison to the child five months old. Sudden pains above the left nipple. RIGHT side.

Croton tig. Sucking is accompanied with an excruciating pain in the breast, which runs through to the corresponding scapula and arm, increased heat throughout the body. Rheumatic pains in the large joints. Intense itching of the skin, yellowish diarrhœa, that escapes suddenly and with force.

Cuprum. Swelling and induration of the mammæ. Distressing after pains, particularly in women who have borne many children. Scantiness or suppression of urine. The mind acts slowly. She shrinks from every one who approaches her. Restless. Gurgling noise when drinking. LEFT side.

Curare. Inflammatory swelling of the mammæ. Hard tumors like scirrhus; abscesses. Ulcers and fissures of the nipple. Drawing, burning, lancinating pains extending from the mammæ into the axilla. Pain in the ovaries. Mastitis, with retarded menses. Sexual desire, with furor uterinus.

Cyclamen. Sensation of enlargement of the mammæ. Glands hard and painful. Discharge of a milky, watery fluid from the breasts, with relief of the other symptoms, (galactocele) violent stitches about the left nipple at 4 P. M. Feeling as though hot air was streaming out of the breast. Menstrual flow black and clotted. Secretion like milk from the mammæ before menstruation. Swelling of the breasts after menstruation, with a discharge like milk. Watery milk in those not pregnant.

Dulcamara. Throughout the day, uneasiness in the

mammary region, especially the LEFT, extending to the left shoulder, and upper part of the arm. Suppression of the milk by a cold. Nipples sore. Herpes on the breasts of nursing women, LEFT side.

Fagopyrum. Severe stitching pains in the breast, often returning; sharp stitch like the prick of a needle in the RIGHT breast on respiration; menses too early.

Ferrum. Wandering sticking pains in the breast. Heavy sore feeling below the LEFT nipple.

Formica. Violent penetrating itching of the RIGHT nipple; menses too early; menses with headache; rheumatism; deficiency of milk; trouble caused by cold and wet, cold bathing or damp weather. *Aggravated* from 2 to 4 A. M. *Relieved* (burning) by the application of cold water.

Galium aperinum. Carcinoma of the mammæ.

Graphites. Nipples inflamed and cracked. Tettery eruption between the fingers and on the scalp; styes; useful where there have been ulcerations. Cicatrices from ulcers; the milk is prevented from flowing by old cicatrices; pulsation throughout the body; fetid nocturnal perspiration; nostrils excoriated with dry scales in the nose; black pores on the face and nose. Suppression of the menses; great prostration. Graphites will prevent the formation of pus. Soreness of the nipples, with small corrosive blisters. *Aggravated* at night, and before midnight.

Gratiola. Darting in the RIGHT mammæ, felt when bending the body, but worse when raising it again. Tearing in the milky breast.

Gymnocladus c. Fain in the RIGHT breast, stitches in the RIGHT breast during respiration.

Hall. Breasts small and flabby. Burning and stitching in the LEFT mamma. Mammæ so sensitive they can scarcely bear the pressure of the clothing. Heaviness, and feeling as though they would fall off. *Aggravated* at night.

Hamamelis v. Bleeding nipples, with excessive soreness.

Helonias d. Breasts swollen, the nipples are painful and very sensitive, even to the pressure of the dress; intense pruritus of the vulva and vagina, with curdy secre-

tion from the vulva; soreness of the breasts before and during menstruation. Loss of sexual desire and power; uneasiness and weight in the region of the kidneys. Prolapsus.

Hepar s. c. Cracks in the breasts and nipples; dull pains as during the formation of pus; when suppuration begins with frequent crawlings; tetters on different parts of the body, with a hard yellow crust, from under the edge of which pus exudes. Dry heat, sour nocturnal perspiration; she dislikes to be uncovered. Adapted to persons who have taken much mercury: pus scanty, excessive hardness of the inflamed parts. *Aggravated* at night. RIGHT side.

Hura brasilienis. Much painful shooting in the LEFT breast. Throbbing in the LEFT breast.

Hydrastis canadensis. Scirrhus of the mammæ, hard, heavy, and adherent to the skin; the skin is dark, mottled and puckered. The nipple is retracted, with pain as if knives were thrust into the parts. Cachectic countenance. Constipation. Hemorrhoids; catarrh of the bladder. Tenacious leucorrhœa. Ulceration of the os, cervix and vagina. Sensation of weakness in the stomach. Flushes of heat to the face, neck, and hands. Irritable and indolent ulcers. Soreness of the breasts and nipples, especially at the time of menstruation, with leucorrhœa.

Ignatia. Milk disappears from both breasts. Stitches in the nipple on deep respiration. Menstruation increased.

Indigo. Long continued burning behind the LEFT mamma. Many neuralgic pains in the breast. Burning in the mammæ during menstruation. Stinging in the mammæ during menstruation, relieved temporarily by friction. *Aggravated* by rest, and when sitting in the afternoon.

Iodum. Acute pains in the breasts connected with metritis. Breasts sore and sensitive. Swelling of the cervical glands. Heavy sensation in the breasts. Dark colored nodosities under the skin of both mammæ of the size of a hazel nut, surrounded by black spots. Breasts hang down and are flaccid. Atrophy of the breasts. Dwindling of the mammary gland, and of glandular tissue generally.

Great weakness, especially when ascending the stairs. Remarkable and extreme emaciation. Leucorrhœa, corrosive, staining the linen yellow, during the menses. *Aggravated* in the morning and at night, by mild contact, in the warm open air, and by warmth generally. LEFT side.

Kali carbonicum. Sharp shooting and violent sticking in the LEFT mamma. Stitches beneath the LEFT breast, extending upwards. Burning neuralgic pains in the mammæ. *Aggravated* in the evening.

Kali jodatum. Breasts diminished in size, the supply of milk decreased. Atrophy of the mammæ.

Kreasotum. Frequent drawing pains from the sides of the nipples. Stitches, as with a dull needle, under the LEFT mamma, and right scapula, which arrest breathing. The breast is hard, bluish-red, and covered with little scurvy protuberances, from which blood oozes when the scurf is removed. Sensation as if milk would flow into the breasts, with increased flabbiness. In nursing women the parts become withered. Sharp sticking pains. Menses too early. Appearance of the menses in the third month of pregnancy. Syphilitic taint. All the discharges are corrosive. Chilliness. Increased flow of urine, especially during the night.

Lachesis. The breasts are of a purple or blue color. Hammering pains. Pressure on the tumor causes a pain in the LEFT arm and shoulder. Ulcerated carcinoma, with black streaks of coagulated blood in the ulcer. Chronic leucorrhœa. Threatened gangrene. Chills at night, flushes of heat during the day. Troubles at the climacteric period. Pains in the LEFT ovary. Pains in the uterus. An effort is required to speak. Feeling as though the labor pains extended up into the breasts; stitches in the LEFT nipple. *Aggravated* after sleep by pressure, by lying on the right side, or painless side. *Relieved* after eating, and by the menstrual flow, (uterine pains).

Lactic acid. Sharp pain in the RIGHT breast at 11 A.M. Throbby, sharp pain in the right breast.

Lactuca vir. The quantity of milk in the RIGHT breast is increased. Frequent and copious urination at night. Ill humor. Difficult respiration, with oppression of the

chest. Rheumatic pains in the extremities. Increases the flow of milk when inclined to become dry.

Lac. can. Breasts sore, and full of small hard lumps, like marbles, during menstruation; constant burning in the mammæ and nipples. Profuse flow of milk. Useful to dry the milk.

Lapis alb. Carcinoma of the mammæ.

Laurocerasus. Fine needle like stitches beneath the LEFT mamma. Early menstruation.

Lepedium. Sensation as of a cord around the RIGHT breast. Lancination in the RIGHT breast. Congestion and hardness of the breasts. Itching of the nipple.

Lilium tigrinum. Faintness after standing, or in a warm room. Severe cutting pain in the LEFT mammary gland, in the morning, extending through to the left shoulder blade. Crampy pains in the LEFT breast, extending down the corresponding arm. Sharp pain in both breasts. Dull aching in the LEFT mamma under the shoulder blade. The pains decrease until she has almost fallen asleep, when their renewed severity awakens her suddenly. Drawing in the axilla. Sub-acute inflammation. Uterine neuralgia, with cutting pain in the LEFT ovary. Profound uterine troubles, with displacement, principally anteversion. Apprehensive concerning own health, and disease. All the symptoms return suddenly.

Lobelia inflata. Burning in the breast, passing upward. Lightness of the breasts, with heat to the forehead. Drawing in the LEFT breast from the nipple to the axilla.

Lycopodium. The nipples bleed, and are very sore. The nipples bleed, and exude a glutinous fluid when touched. Swelling of the mammæ with nodosities in the axilla. Enlargement of the breasts, which are painful to touch. Red sand in the urine. Sensation of fermentation in the abdomen. Accumulation of wind in the small intestines. Chronic dryness of the vagina. Menses too early and profuse. Exceedingly putrid odor from the mouth. Fan-like motion of the ali nasi. Cough, with a gray saltish expectoration. Cutting pains, running from RIGHT to LEFT; during the paroxysm she is obliged to walk

about and weep. Fear of being left alone. *Aggravated* about 4 P.M. from warmth and moisture. *Relieved* after 8 P.M. RIGHT side.

Magnesia carbonica. Burning, and sharp stitches beneath the LEFT breast.

Mercurius. Several abscesses in the breast. Hardness and soreness of the breasts. Ulcerated nipples. The child refuses the milk. Syphilitic origin. The gums recede from the teeth. The whole body feels sore, as if bruised. Coldness and shuddering through the body. Pains in the breasts at each menstrual period, as if they would ulcerate. Profuse sweat, without relief. Useful after belladonna. Pains periodical. *Aggravated* at night in bed. *Relieved* by cold. LEFT side.

Mercurius corr. Painful glandular swelling about the nipple. Breasts painful, and in bed, sharp and shooting pains in them.

Mercurius solubilis. Swelling of the mammæ, especially of the nipples, which are harder than usual. Periodic pains in the mammæ, as if there would be suppuration; corrosive leucorrhœa. Leucorrhœa from 8 to 10 P.M. Menstruation too profuse.

Moschus. A pressive pain in the LEFT breast, as though the pain would force itself through the nipple.

Murex pur. Violent pains in the breasts with acute stitches; darting pains in the mammæ; sharp shooting pains in the RIGHT side of the uterus from below upward, across the thorax, to the LEFT breast. The menses are too early and too profuse. Sexual organs easily excited by a touch, as during digital examination. Leucorrhœa acrid, and sometimes bloody. Distressing dreams, general lassitude and feebleness. *Aggravated* at night. RIGHT side.

Muriaticum acidum. Drawing in the RIGHT mamma, beneath the nipple. Fine burning stitches externally beneath the LEFT nipple.

Naja. Secretion of milk very much decreased. Occasional pain at the top of both mammæ. Ovarian neuralgia.

Natrum muriaticum. Lancinating pains in the breasts. The upper lip is swollen, cracked and dry. Breasts sensi-

tive to the slightest pressure. Headache which comes on in the morning, is at its height about noon, and gradually declines as the sun sets. Great desire for salt, and aversion to bread. Gloomy and sad during the menses. Dryness of the vagina, which is painful during coition. Menses retarded and diminished; complete indifference to the affairs of life. One half of the tongue feels stiff. The discharges are all excoriating and biting. *Aggravated* in the morning about 10 o'clock. *Relieved* in the open air, and while lying on the RIGHT side, or back.

Nitric acid. Hard nodosities in the mammæ. Hard lumps in the breast. Atrophy of the breast; shooting pains as if caused by splinters. The pains are felt during sleep. Soreness of the folds beneath the breasts. Syphilitic taint. Mercurial poisoning. Salivation. Fissure of the anus. The urine smells like that of horses. Menses too early and too profuse. Leucorrhœa flesh-colored or greenish. Sadness concerning one's health. Swelling of the axillary glands, with suppuration. Menses relieved by moving, or riding in a carriage. *Aggravated* in the evening. LEFT side.

Nux moschata. Breasts small and without milk. Diminishes the milk of nursing women. Between the breasts there is an offensive odor; chronic diarrhœa. Dryness of the mouth and tongue. Suppression of the menses from exposure to dampness. Skin dry with no disposition to perspire. Flatulence which disturbs sleep at night. Sudden change of humor; disposed to laugh immoderately. *Aggravated* in cold damp weather, when lying on the painful side, and in the forenoon, and evening. Very sensitive to the cold air, and to any draught of air.

Nux vomica. The nipples are painful during sucking, with little or no soreness or rawness. Pain in the nipples as if milk would be secreted. Constipation during pregnancy. Repugnance to the open air, uneasiness at 3 A.M. Shivering across the breasts. Malicious, irritable temperament. Pain in the small of the back—hemorrhoids. *Aggravated* on rising in the morning, by turning in bed (back). Left side.

Oleum a. Dull stitches around the lower portion of the LEFT mamma, with painful tearing to the ring and middle

fingers of the RIGHT hand. Paralytic weakness in the limbs. Sadness. Aversion to meat. Menses premature and scanty. Stiffness of the neck. *Relieved* momentarily by rubbing, (pains).

Paullinia innata. Lancinating pain as if a knife were thrust into the LEFT nipple at irregular intervals. Momentary stabbing sensation in the ovaries.

Petroleum. Itching, with mealy covering of the nipples. Menses premature. Sadness and discouragement, starting from trivial causes. Marked sensitiveness of the skin. Excessive weakness without apparent cause.

Phellandrium. A protracted stitch through the RIGHT mamma, near the sternum, extending to the back, between the shoulders. Menstrual flow only in the morning and evening.

Phosphorus. Phlegmonous inflammation, breasts swollen, hard knots, red in spots and streaks, fistulous openings that discharge a watery, discolored, offensive ichor. Lymphatic abscesses. Fungous hæmatodes. Hacking cough, with hectic fever and colliquative sweats. Slender women with white and tender skin, light hair and blue eyes. Weakness from disease, or from loss of animal fluids. Stinging and cutting pains. Desire to be mesmerized, great mental depression at twilight. Increased sexual desire. Menses too early and profuse ; tightness across the chest. Stitches and milk in the breasts with amenorrhœa. *Aggravated* in the morning and evening, when lying on the back and after a meal. *Relieved* by quiet. LEFT side.

Phosphoric acid. Milk scanty. Weakness from loss of animal fluids. Bad effects of sexual abuse. Large quantities of colorless urine are voided at night. Profuse leucorrhœa. Pains in the bone. *Aggravated* in the morning and evening.

Phytolacca. Tumor in the breast. Aggravated during menstruation. Irritable mammæ from painful menstruation. Irritable tumor of the breast, aggravated at menstruation, with pains running down the affected arm, and enlargement of the axillary glands. Breasts exceedingly hard. Chill a few days after confinement, followed by fever,

and painful engorgement and swelling of the breasts. Hardness is apparent from the first. Many painful nodosities. Abscesses of the breast. Badly managed cases of mammary abscess. Large fistulous openings, and angry-looking ulcers filled with unhealthy granulations, which discharge a watery, fetid, ichorous pus ; fissured nipples. The milk cannot be drawn, because of the cakes in the breast ; when the child takes the nipple in its mouth an exquisite pain radiates from the nipple all over the body, going to the spine, and streaking up and down the back, with excessive flow of milk, causing much exhaustion. Constipation. *Aggravated* during moist weather.

Plantago major. Without especial indications, has been used topically in erysipelatous inflammation of the breast ; may also be useful when the origin of the trouble is traumatic.

Plumbum. Painful constriction in one or both breasts, during which they become hard. The milk is very scanty. Sudden attack of severe pain in the LEFT mamma. Constant boring, extending to the back. LEFT breast suppurates about the nipple, and discharges a serous fluid. RIGHT breast contains a large induration, firmly adherent toward the outer portion, of livid color, with red streaks, stitches in the RIGHT breast. Vaginismus ; miscarriage.

Pulsatilla. Swelling of the breast, with pressure ; tensive as if milk would appear. Painful, and a discharge of thin acrid milk. When nursing, a pain proceeds from the breasts into the neck, and down the back ; pains frequently change their location. Rheumatic pains proceeding from the breasts to the upper part of the body. She cannot remain long in one place. She must move about to relieve the pains. Itching of the nipples. Milk scanty. Mild, tearful disposition, symptoms changeable, chilliness without thirst. Diseases caused by wetting the feet, dizzy when rising from a chair, or when looking up. Bitter taste in the mouth, menses late or suppressed. Painful menstruation, the flow giving no relief. Leucorrhœa profuse after menses. *Aggravated* in the afternoon, evening, before midnight, and by warmth. *Relieved* by cold, and in the open air. LEFT side.

Resina itu. Pain in the LEFT breast, when walking. Excessive itching in the LEFT breast, and nipple. *Aggravated* in the morning.

Rhus tox. Erysipelatous inflammation of the breast, with small vesicles. Inflammation that arises from weaning, from a chill, and after getting wet. Breasts red and streaked. Painful distention of the breasts after delivery, when the milk begins to flow. Coldness with the pains, fever in the evening. The lochia becomes red again. After delivery there is a pain in the RIGHT leg, with numbness from the hips to the foot ; cough after delivery. Milk in the mammæ, with leucorrhœa. *Aggravated* after midnight, in damp weather, and during rest. *Relieved* by motion.

Robinia. Swelling of the breasts, with great affluence of milk. Inflammation, swelling and induration of the mammary gland, and axillary glands. A small hard tumor in the mammæ, pricking and creeping pains in the breast. Hard scirrhus swelling of the neck of womb. Stinging of the uterus. Hemorrhage between the menses. Acrid leucorrhœa, yellowish, and most fetid. Sensation of something in the womb. Nymphomania.

Sanguinaria. The breasts are sore when touched. Stitches in the breasts. Burning and pressing in the breasts, stitches from the lower part of the LEFT breast to the shoulder. Acute stitches in the RIGHT breast. Painful soreness of the nipples, pressure is painful. Pain in the RIGHT breast extending to the stomach, causing a sickening sensation. Menses too early. Flushes of heat at the change of life. Headache like a flash of lightning on the occipital region. Headache in the RIGHT side of the forehead, with sensation as if the eyes would be forced out of the head. Burning of the palms of the hands, and soles of the feet. Severe neuralgic pains in all the muscles.

Sanacinia. Swelling of the mammæ, with excessive secretion of milk. Many abscesses and fissures of the nipples. Mammæ soft during menstruation. Spasmodic pain in the RIGHT ovary. Foul smelling leucorrhœa. Abundant menstruation. Emaciation.

Sarsaparilla. Nipples soft, invisible, and not irritable.

Secale cornutum. Stinging in the breasts, deficiency of milk ; venous hemorrhage with exhaustion ; lochia thin and offensive. Menses early and profuse. Cachectic, scrawny women. Skin cold, desire for cold air. Face pale and eyes sunken. *Aggravated* before menses, and at night.

Sepia. Stinging in the breasts, with soreness of the nipples ; deep cracks in the nipples ; urine very offensive. Sensation as if everything would fall out of the vulva ; to prevent this she must cross her legs. Stitching pains in the uterus, painful coition, itching of the vulva, lochia offensive and excoriating. Inflammation of pregnant women; profuse perspiration during the slightest movement ; indifference to one's relations. Wakes about 3 A. M., and cannot sleep again. Feeling of goneness in the stomach ; anxious concerning one's health, menses delayed and scanty. The smell of cooking is unpleasant to her. Leucorrhœa after menstruation. *Aggravated* in the evening.

Silicea. Inflammation of the nipples. Phlegmonous inflammation. The breasts are bright red. The RIGHT breast is hard and painful, and swollen about the nipple, excessive itching of the swollen gland ; it feels as if it were gathering. Ill conditioned pus. Tendency to take cold in the head : she is chilly much of the time. Profuse perspiration at night, having an acrid odor. Suppression of the menses ; icy coldness at the appearance of the flow. Itching of the vulva, with biting leucorrhœa, constipation before and during the menses. She is hungry but cannot eat ; a repugnance to cooked or hot food. She desires to be mesmerized. Diseases caused by exposing the back to a draught of air. *Aggravated* in the afternoon and at night, and at the new moon. *Relieved* by lying on the painful side, and by warmth.

Spiranthus. Abundance of milk, especially in the LEFT breast. Pain in the breast on raising the arms.

Spongia tosta. Induration and hardness of the breasts before the catamenia. Indurations reappearing about a week before menstruation. Induration in the LEFT breast coming in the evening and disappearing the following morning. Itching of the breasts. Goitre. Muscular twitchings ;

she wakes frequently with a start. Glandular swellings on the RIGHT side. *Aggravated* at night.

Stannum. Violent itching of the nipples. Itching of the vulva.

Strychninum. Severe throbbing pains in the RIGHT breast, passing through to the back. Violent tearing pains in the LEFT breast.

Sulphur. Sore and cracked nipples, that bleed while nursing. The areolæ are covered with yellowish scabs, from underneath which there oozes an acrid fluid, causing itching and burning. Inflammation issuing in radii from the nipples ; chilliness in the morning, and heat in the afternoon ; burning and stinging in the breasts. Affections caused by exposure to a current of air ; excessive sensitiveness to the open air. The heat of the bed is unbearable, profuse perspiration ; unrefreshing sleep, flushes of heat on the body. Hungry and weak between eleven and twelve A. M. Urgent desire to urinate ; if this is not gratified, the urine passes involuntarily. Toothache precedes the menses. Irritable disposition. Scrofulous diathesis ; especially useful after pulsatilla. *Aggravated* at night. LEFT side.

Sulphuricum acidum. Violent sticking in the RIGHT breast ; when pressing upon it the pain extends deeper. Excessive weakness.

Tabacum. Violent sore pain in the RIGHT mamma, with a sensation as if the nipple were bitten off. Menstruation deranged.

Tarantula. Swelling of the breast, with itching in the nipples. Swelling of the uterus. Hemorrhage from the uterus. Many different pains in the uterus. Excessive sexual excitement. Great restlessness, cannot remain quiet, must constantly move hands and feet. Itching all over the body. Pustular eruption.

Teplitz. In the RIGHT breast, two lumps as large as hazelnuts, with dull pains. Fine pricks as with needles in the RIGHT breast. Leucorrhœa, white, like boiled starch. The catamenia, which had never appeared, began to flow very copiously.

Thuja. Small induration in the LEFT breast close to the

nipple. LEFT mamma hard, tension in the left axillary glands. The glands on the LEFT side, from the neck down, are as large as hazelnuts. Swelling of the RIGHT nipple. Stinging and itching in the breast. Biting and itching in the genitals when urinating. Pain in the LEFT ovary. Slight leucorrhœa.

Urtica urens. The breasts are swollen and filled with serum ; this changes to a milky fluid. Adenoma. Sudden suppression of milk. Suppression of urine, with œdema. Nettle rash that reappears yearly at the same time. Hemorrhages from the uterus, lungs and bowels.

Veratrum viride. Steady pain about the LEFT nipple.

Viburnum opul. Swelling and hardness of the breasts during menstruation.

Zincum. Painful stitches in the LEFT mamma. LEFT nipple very painful and sensitive. Aching in the RIGHT mamma, with pressing. Milk suppressed. She moves her feet constantly. Menses early and profuse relieving the suffering. Discharge of bloody mucus after menstruation. Leucorrhœa preceded by cutting colic. She eats very fast, is fretful, and dislikes conversation. Excessive sensibility of the genital organs, with sexual excitement. *Aggravated* after dinner, and toward evening.

REPERTORY.

I. Aggravations.

AIR, *Cold*, Arsenicum, cistus, clematis, conium.
Either warm or cold, Calcarea c., merc. c.
Open, Baryta c., causticum, nux m., nux v.
Warm, Sodium.

ARMS, *Raising the*, Spiranthus.
Stretching the, Argentum n.

BED, Ammonium c., chamomilla, mercurius, mercurius c.
Heat of, Sulphur.
Rising from, Bryonia, comocladia.
In morning, Nux v.
Turning in, Conium m., nux v.

CLIMACTERIC, Lachesis, sanguinaria.

COFFEE, *From drinking*, Causticum, chamomilla, ignatia, nux v., pulsatilla, sulphur.

COITION, *During*, Natrum m.

COMPRESSION, *From*, Calcarea c.

COUGHING, *From*, Causticum.

DELIVERY, *After*, Rhus tox.

DRAUGHT, *Exposure to*, Nux v.

EXCITEMENT, Calcarea c.

EATING, Borax, carbo. veg., chamomilla, phosphorus.
Dinner, Lactuca v., plumbum, zincum.

FATIGUE, Causticum.

FLATULENCE, Nux m.

HEAT, Apis m., iodum, lycopodium, pulsatilla.

HOUR, *At the*, *of*, 2 to 4 a. m., Formica.
3 a. m., Nux v., sepia.
10 a. m., Natrum m.
11 a. m., Lactic a.
11 to 12 a. m., Sulphur.
3 p. m., Belladonna.
4 p. m., Lycopodium.
8 p. m., Castoreum.
9 p. m., Bryonia.
8 to 10 p. m., Mercurius s.

INSPIRATION, Ignatia.
LOOKING, *Back*, Conium.
Up, Pulsatilla.
LYING, *On the back*, Nux v., phosphorus.
Left side, Baryta c., bromine, lilium tig.
Painful side, Iodum, nux m., nux v.
Painless side, Bryonia, causticum, chamomilla, lachesis.
Right side, Carbo a., lachesis.
MARRIED WOMEN, Cedron.
MENSTRUATION, *After*, Cyclamen : sepia.
Before, Asterias ; calcarea p., conium, helonias, secale c., silicea, spongia, sulphur.
Between, Robinia, zincum.
During, Calcarea c., cicuta v., helonias, hydrastus, indigo, lac can., phytolacca, saracinia, silicea, viburnum o.
MILK, *From drinking*, Bromine, calcarea c.
MOON, *During the increasing*, Clematis.
During the new, Alumina, calcarea c., silicea.
MOTION, Arnica, baryta c., bryonia, sepia.
NURSING, *During*, Croton tig., borax, pulsatilla, sulphur.
Women, Dulcamara, kreosotum.
PAIN, *During*, Plumbum.
PERIODICALLY, Bromine, mercurius, urtica u.
Not, Apis.
PREGNANCY, *During*, Carbo a., cimicifuga, nux v.
PRESSURE, *By*, Bromine, carbo a., cotyledon, helonias, lachesis.
RESPIRATION, Fagopyrum, gymnocladus.
REST, Indigo, lycopodium, rhus tox.
RIDING, Cotyledon u.
RISING, Bryonia, gratiola.
From chair, Pulsatilla.
ROOM, *In*, Iodum, lilium tig., pulsatilla.
SLEEP, *After*, Lachesis.
During, Nux m.
Upon waking from, Calcarea c.
Upon falling, Ammonium c., lilium tig.
SIDE, *Left*, Arum trif., asclepias, asterias rub., berberis, borax, calcarea c., castor eq., cimicifuga, cistus, comocladia, cotyledon, crotalus, cuprum, cyclamen, dulcamara, ferrum, hura, indigo, iodum, kali c., lachesis, laurocerasus, lilium tig., mercurius, moschus, muriatic acid, nux v., phosphorus,

plumbum, resini, sepia, spongia, spiranthus, strychnium, sulphur, thuja, veratrum v., zincum.

Right, Ammonium c., argentum n., arnica, arsenicum, belladonna, bromine, borax, bryonia, cactus g., calcarea c., carbo. a., causticum, cotyledon, comocladia, crotalus, fagopyrum, formica, gymnocladus, gratiola, hall, hepar s., kreosotum, lactic acid, lycopodium, murex p., muriatic a., oleum a., phosphoric a., plumbum, rheum, sanguinaria, saracinia, silicea, strychnium, sulphuric acid, tabacum, teplitz, thuja, zincum.

SITTING, Bryonia, indigo.

STANDING, Lilium tig., oleum a.

STOOPING, Gratiola.

STORM, *During*, Rhus tox.

SUCKLING, Borax, chamomilla, croton tig., nux v., phytolacca, pulsatilla, sulphur.

STAIRS, *Ascending*, Calcarea c., iodum.

Descending, Castor eq.

TIME, *Afternoon*, Belladonna, berberis, cimicifuga, indigo, lycopodium, pulsatilla, silicea, sulphur.

Evening, Arnica, arsenicum, asterias r., bryonia, calcarea c., carbo a., castoreum, causticum, cotyledon, kali c., nitric a., nux m., nux v., phosphorus, pulsatilla, rhus tox., sepia, spongia, zincum.

Forenoon, Nux m.

Midnight, *after*, Arsenicum, mercurius, nux v., phosphoric a., rhus tox.

Before, Bromine, bryonia, chamomilla, graphites, pulsatilla, rhus tox.

Morning, Alumina, argentum n., aurum m., carbo v., conium, formica, helonias, iodum, lilium tig., natrum m., nux v., phosphorus, phosphoric a., resina, sepia, sulphur.

Night, Aconitum n., arnica, arsenicum, bromine, clematis, graphites, hall, hepar s., iodum, lachesis, lactuca v., mercurius, murex p., phosphoric a., pulsatilla, secale c., silicea, spongia, sulphur.

Noon, Natrum m.

Twilight, Phosphorus.

TOUCHED, *From being*, Ammonium c., argentum n., calcarea c., chamomilla, lycopodium, murex p., sanguinaria.

Gently, Belladonna, iodum.

URINATING, *While*, Thuja.
WALKING, *While*, Cotyledon.
WARMTH, Lycopodium, pulsatilla.
WEATHER, *Cold*, Climatis, conium.
Damp, Borax, calcarea c., carbo veg., dulcamara, nux m., rhus tox.
Moist, Phytolacca.
WORKING, *From*, Resina.

II. AMELIORATIONS.

AIR, *in the open*, Comocladia, conium m., natrum m., pulsatilla.
In the cold, Bryonia, mercurius, pulsatilla.
COLD, *Application of*, *water*, Apis m., formica, mercurius.
DISCHARGE, *from the breast*, Cyclamen.
EATING, *After*, Lachesis, phosphorus.
EVENING (8 to 9), Lycopodium.
FRICTION, Indigo.
LACTATION, Cactus g.
LEGS, *Crossing of the*, Sepia.
LYING *down ;* Arnica.
on back, Natrum m.
on painful side, Bryonia, silicea.
on right side, Natrum m.
MENSTRUATION, *During*, Lachesis, zincum.
MOTION, Comocladia, indigo, nitric a., rhus tox.
PRESSURE, *From*, Indigo.
QUIET, *From*, Phosphorus.
RIDING, *In a carriage*, *while*, Nitric acid.
RUBBING, *Gentle*, Indigo, oleum a.
SUNSET, *At*, Natrum m.
SWEATING, Chamomilla.
WALKING, Conium m.
WARMTH, Arsenicum, conium m., silicea.
WATER, *Application of*, Formica.

III. DESIRES.

DESIRE FOR AIR, *cold*, Carbo v., secale c.
open, nux v.
mesmerized, *to be*, Phosphorus, silicea.
salt, *to eat*, Natrum m.

IV. Aversion.

Aversion, *to bread*, Natrum m.
to conversation, Zincum.
to cooked, or hot food, Silicea.
to society, Conium m:
to being uncovered, Clematis, hepar s.

V. Pains.

Aching, Calcarea c., cimicifuga, conium m., cotyledon, lilium tig., zincum.
Acute, Iodum.
Boring, *Constant*, Plumbum.
Broad, Cotyledon u.
Burning, Arsenicum, carbo veg., cistus, comocladia, curare, indigo, kali c., lac. can, lobelia, magnesia c., sulphur.
Fine, Muriatic acid.
Constant, Cotyledon u., veratrum v.
Contractive, Borax.
Cramping, Lilium tig, robinia.
Cutting, Lilium tig., lycopodium, phosphorus.
Darting, Gratiola, murex p.
Direction of pain, *behind, forwards*, Oleum a.
Right to left, Lycopodium.
Towards the Axilla, Argentum n.
Upwards, Kreosotum, murex p.
Drawing, Asterias r., curare, kreosotum, lobelia, oleum a., muriatic acid.
Dull, Cotyledon u., hepar s., lilium tig., oleum a., teplitz.
Ecchymosed, *As if the parts were*, Calcarea c.
Gnawing, Bufo.
Hammering, Lachesis.
Increasing, Arsenicum.
Irregular, Paullinia, lilium tig.
Knives, *As if cut with*, Hydrastus, paullinia.
Lancinating, Asterias, baryta c., bromine, paullinia, bufo, curare, lepidium, paullinia, rheum.
Lightning, *Like flashes of*, Sanguinaria.
Movable, Ferrum, pulsatilla.
Needle, *As if a dull, were thrust into the part*, Fagopyrum, kreosotum, laurocerasus.
as of a, Teplitz.

PAROXYSMAL, Cimicifuga, clematis.
PERIODICAL, Bromine, mercurius, mercurius c., urtica u.
PRICKLING, Cimicifuga.
PRESSURE, Moschus.
RADII, *Spreading in*, Belladonna, phytolacca, sulphur.
RHEUMATIC, Croton tig., formica, lactuca v., pulsatilla, rhus tox.
SEVERE, *Very*, Calcarea ox.
SHARP, Comocladia, kreosotum, kali carb., kreosotum, murex p.
SHOOTING, Asclepias tub., belladonna, bryonia, hura, kali carb., mercurius c., nitric acid.
SPASMODIC, Saracinia.
SPLINTER, *As from a*, Nitric acid.
STABBING, Paullinia, strychninum.
STICKING, Aconitum nap., belladonna, berberis v., fagopyrum, ferrum, phellandrium.
STINGING, Apis m., indigo, phosphorus, robinia, secale c., sepia, sulphur, sulphuric acid, thuja.
STITCHING, Bryonia, calcarea c., clematis, conium m., cyclamen, hall, kreosotum, murex p., oleum a., pulsatilla, sanguinaria, sepia, zincum.
SUDDENLY, *Come and go*, Belladonna, plumbum.
TEARING, Baryta c., belladonna, cicuta v., gratiola, oleum a.
THROBBING, Belladonna, hura, lactic acid.
WAVY, Cimicifuga.
VIOLENT, Tabacum.

VI.—OBJECTIVE SYMPTOMS OF THE BREAST.

AREOLA, Castor eq., sulphur.
ATROPHY, Chimaphila, conium, iodum, kali jod., nitric acid.
ENGORGEMENT ; Lycopodium ; phytolacca.
ERUPTION, *between the breasts*, Asterias.
    Offensive odor of, Nux m.
FLABBINESS, Conium, hall, iodum, kreosotum.
HARDNESS, Apis m., arnica, belladonna, bryonia, conium m., hepar s., kreosotum, lycopodium, mercurius, phytolacca, plumbum, silicea, spongia, viburnum.
NIPPLES, *Aphthous*, Borax.
    Bleeding, Borax, hamamelis, lycopodium, sulphur.
    Burning, Arundo, mauri, benzoic acid, cicuta, muriatic acid.
    Cracked, and fissures of, Aurum s., castor eq., causticum, curare, hepar s., phytolacca, sarracinia, sepia, sulphur.

Excoriated, Arnica, calendula, causticum.
Hard, Mercurius s.
Inflamed, Cadmium, graphites, silicea.
Itching of, Arnica, conium m., formica, lepidium, petroleum, pulsatilla, resina, stannum, tarantula.
Painful, Cicuta v., cotyledon, helonias, nux v.
Retracted, Hydrastus, sarsaparilla.
Soft, Sarsaparilla.
Sore, Arnica, belladonna, calcarea c., calcarea p., castor eq., chamomilla, croton tig., ferrum, hamamelis, helonias, lycopodium, mercurius, sanguinaria, sepia, sulphur.
Stinging, in, Camphor, saracinia.
Swelling of, Mercurius s., thuja.
Touch, sensitive to the, Arsenicum jod., zincum.
Ulcerated, Mercurius, arsenicum jod.

SKIN OF THE NIPPLES, *Adherent*, Asterias, hydrastus, plumb.
Excoriated, Graphites.
Dark, Arsenicum, conium, hydrastus, lachesis, nitric acid, secale c.
Livid, Plumbum.
Mealy, Petroleum.
Purple, Lachesis.
Red, Apis m., arnica, conium, rhus tox., silicea.
bright, Belladonna.
not, Calcarea c., crotalus.
in spots, Phosphorus.
like bee stings, Apis. m., iodum.
in streaks, Belladonna, phosphorus, plumbum, rhus tox., sulphur.
Scabby, Sulphur.
Scaly, Conium m.
Scurfy, Kreosotum.

SMALL, *breasts*, Hall, nux m.

SWELLING, Apis m., asafœtida, asteria, baryta c., belladonna, bromine, calcarea c., carbo veg., castor eq., cedron, chamomilla, clematis, conium, cuprum, cyclamen, helonias, iodum, lycopodium, mercurius s., natrum m., phosphorus, phytolacca, pulsatilla, robinia, saracinia, tarantula, urtica u., viburnum.

TENDER, Nux m.

WHITE, Nux m.

VII. Concomitant Conditions, and Symptoms.

Abdomen, Calcarea c., cotyledon, lycopodium.
Abortion, Cimicifuga.
After-pains, Cuprum.
Air, *Sensitive to the*, Calcarea c., nux m., sulphur.
Amenorrhœa, Phosphorus, rhus tox.
Anus, Nitric acid.
Appetite, Rheum.
Arms, Asterias, comocladia.
Axilla, Curare, lilium tig., lobelia.
Axillary *glands*, Argentum n., bufo, carbo a., carbo v., carboneum, chimaphila, nitric acid, phytolacca, robinia, sulphur, thuja.
Back, Causticum, cimicifuga.
Small of the, Nux v.
Bones, Phosphoric a.
Bladder, Hydrastus.
Blisters, Graphites.
Body, *feels sore*, Mercurius.
Bowels, Urtica u.
Breathing, Ammonium c., calcarea c., kreosotum.
Burning, Arsenicum, berberis, calcarea p., chamomilla, croton tig., indigo, sanguinaria, sulphur.
Catarrh, Hydrastus.
Chest, Berberis, cotyledon, lactuca, murex p., phosphorus.
Child, *refuses the breast*, Mercurius.
Chilliness, Pulsatilla.
Cicatrices, Graphites.
Clairvoyance, *State of*, Phosphorus.
Coccyx, Cicuta v.
Coition, *Painful*, Natrum m., sepia.
Coldness, Calcarea c., kreosotum, mercurius, rhus tox., silicea, sulphur.
Cold, *with little vitality*, Calcarea c.
Complexion, *Grayish earthy*, Bromine.
Constipation, Bryonia, hydrastus, nux v., phytolacca, silicea.
Constriction, *Sensation of*, Borax.
Congestion, *Sensation of*, Calcarea c.
Cord, *Sensation as if, around the breast*, Lepidium.
Cough, Causticum, lycopodium, phosphorus, rhus tox.
Diarrhœa, Croton tig., nux m., sanguinaria.

LABOR PAINS, *Sensation as if they extended to the breast*, Lachesis.
LAMENESS, Calcarea c., cimicifuga.
LASSITUDE, Calcarea c., murex p.
LEGS, Argentum n., rhus tox.
Milk, Bufo.
LEUCORRHŒA, Calcarea p., causticum, chamomilla, conium m., hydrastus, iodum, lachesis, murex p., mercurius s., nitric a., phosphoric acid, pulsatilla, robinia, saracinia, zincum.
LIMBS, *Involuntary starting of*, Cicuta v.
LIPS, Ammonium c., natrum m.
LOCHIA, Carbo veg., benzoic acid, rhus tox., secale c., sepia.
LUNGS, Phosphorus, urtica u.
MENSES, *in clots*, Ammonium c., belladonna, cyclamen.
Early, Ammonium c., fagopyrum, formica, indigo, kreosotum, laurocerasus, oleum a., petroleum, sanguinaria.
Early and profuse, Borax, calcarea c., carbo v., causticum, lycopodium, murex p., nitric a., phosphorus, pulsatilla, secale c., zincum.
Irregular, Aurum s.
Late, Cicuta v., curare, natrum m., pulsatilla, sepia.
Painful, Pulsatilla.
Pregnancy ; in third month of, Kreosotum.
Profuse, Carbo veg., carlsbad, mercurius, saracinia, sulphur.
Scanty, Baryta c., natrum m., oleum a., sepia.
Suppressed, Arum trif., bromine, cimicifuga, graphites, nux vom., pulsatilla, silicea.
MILK, *Acrid*, Pulsatilla.
In women not pregnant, Asafœtida.
Bitter, Rheum.
Child refuses, Mercurius.
Copious, Saracinia.
Curdles easily, Borax.
Flow prevented, Graphites, phytolacca.
Impossible, Phytolacca.
Increased, Arundo, lac. can., lactuca v., robinia, spiranthus.
Scanty, Baryta c., bryonia, causticum, formica, kali hyd., nux m., phosphoric a., plumbum, pulsatilla, secale c.
Suppressed, Dulcamara, ignatia, nux m., silicea, urtica u., zincum.
MOUTH, Arsenicum, lycopodium, nux m.
MUSCLES, Calcarea c., sanguinaria, spongia.

VIII. Mental Symptoms and Conditions.

INDIFFERENCE, Natrum m.
To one's relatives, Sepia.
IRRITABLE, Chamomilla, lactuca v., mercurius, sulphur.
LAUGH, *Disposition to*, Nux m.
MELANCHOLY, Causticum, cimicifuga.
MENTAL *action slow*, Cuprum.
MILD, *tearful*, Pulsatilla.
MISFORTUNE, *Foreboding of*, Calcarea c.
OBSTINATE, Calcarea c.
RESTLESS, Cimicifuga.
SADNESS, Clematis, natrum m., nitric a., oleum a., petroleum.
SHRINKS *from the approach of people*, Cuprum.
SPEAKS *hastily*, Hepar s.
TIME *seems to pass slowly*, Argentum n.

IX. DISCHARGES.

ACRID, Carbo a., carbo v., conium, murex p., robinia, silicea, sulphur
BLOODY, Murex p., phytolacca.
CORROSIVE, Iodum, kreosotum, mercurius s.
CURDY, Helonias.
EXCORIATING, Carbo v., natrum m., sepia.
FLESH-COLORED, Nitric acid.
FOUL, Carbo a.
GLUTINOUS, Lycopodium.
GREEN, Nitric acid.
MILKY, Cyclamen.
MUCOUS, *Bloody*, zincum, silicea.
OFFENSIVE, Borax, carbo a., carbo v., phosphorus, robinia, saracinia, secale c., sepia.
PROFUSE, Phosphoric a.
PUS, *Fetid*, Chimaphila.
Ill-conditioned, Silicea.
Scanty, Hepar s.
SMARTING, *causes*, Chamomilla.
TENACIOUS, Hydrastus.
THIN, Secale c.
WATERY, Phosphorus, phytolacca.
WHITE, Teplitz.
YELLOW, Robinia.

X. Fever and Concomitants.

Coldness, Mercurius.

Chills, Lachesis, phytolacca.

Fever, Belladonna, castoreum, phytolacca, rhus tox.

Hectic, Chimaphila, phosphorus.

Puerperal, Bryonia.

Pulse, *Hard*, Aconitum, nep.

Irregular, Arsenicum, mercurius.

Strong, Belladonna.

Weak, Arsenicum.

Sweat, Arsenicum.

Better after, Chamomilla.

Nocturnal, Graphites.

Not relieved by, Mercurius.

Sour, Hepar s.

Thirst, Aconitum n., bryonia, cistus c., hepar.

For smaller quantities, Arsenicum.

Little, Belladonna.

Without, Apis m., pulsatilla.

XI. Pathology.

Abscess, Bufo, camphor, curare, hepar s., mercurius, phytolacca, tarantula.

Chronic, Calcarea hypophos.

Lymphatic, Phosphorus, phytolacca.

Adenoma, Argentum n., baryta c., conium m., graphites, iodum, lycopodium, urtica u.

Carcinoma, Arnica, arsenicum, asterias, aurum m., belladonna, calcarea c., clematis, conium, crotalus, galium, lachesis, lapis alb.

Erysipelas, Bufo, belladonna, cadmium, carbo a., carbo v., chamomilla, phosphorus, plantago m., rhus tox.

Fissure, Castor eq., graphites, natrum m., nitric acid.

Fistula, Phosphorus, phytolacca.

Fungous hæmatodes, Arsenicum, carbo a., clematis, kreosotum, phosphorus, sepia, zincum.

With adhesions, Bromine.

Galactorrhœa, Borax, cyclamen.

Gangrene, Lachesis.

Glands, *Indurated and swollen*, Badiago, bromine, calcarea c., calcarea p., iodum, mercurius, spongia, thuja.

HYPERTROPHY, Conium m., iodum, nitric acid.

INDURATION, Asterias, belladonna, carbo a., cistus, clematis, chamomilla, conium m., cuprum, mercurius, phosphorus, plumbum, sepia, silicea, sulphur.

INFLAMMATION, Belladonna, bryonia, bufo, calcarea c., calcarea s., cactus, carbo a., carbo v., carduus, chamomilla, cistus, conium, curare, hepar s., iodum, mercurius, phosphorus, phytolacca, plantago, rhus tox., robinia, sepia, silicea, sulphur.

LACTEAL DUCTS, *Obstruction of*, Cicuta v.

LUMPS, *nodosities*, Arsenicum jod., arum trif., aurum, bryonia, bufo, cactus, calcarea p., carbo a., curare, iodum, lac. can., lycopodium, nitric acid, phosphorus, phytolacca, plumbum, teplitz, thuja.

With adhesions, Bromine.

POLYPUS, (*uterine*) Bufo.

SCIRRHUS, Bromine, calcarea jod., carbo a., carbo v., chamomilla, chimaphila, clematis, conium m., hydrastus, robinia, staphisagria, sulphur.

SINUSES, Bufo.

SUPPURATION, Hepar s., kreosotum, mercurius, nitric a., phosphorus, plytolacca, silicea.

SWELLING, Asterias, aurum s., benzoic acid, nitric acid.

ULCERATION, Apis m., arsenicum, asterias, chimaphila, comocladia, crotalus, hepar s., hydrastus, lachesis, mercurius, phytolacca, sepia, silicea, sulphur.

With streaks of black blood, Lachesis.

TUMORS, *Fibroid*, Arsenicum, bromine, conium, lachesis, mercurius.

Indolent, Carboneum s., chimaphila, phytolacca, robinia.

Irritable, Phytolacca.

XII. EXCITING CAUSES.

AIR, *Cold*, Cimicifuga, dulcamara, formica.

Exposure of back to, Silicea.

To current of, Sulphur.

To draught of, Nux m.

BATHING, Formica.

Sea, Arsenicum.

CLIMACTERIC, Lachesis.

DAMPNESS, Nux m.

DYSMENORRHŒA, Phytolacca.

FEET, *Getting wet*, Pulsatilla.
FLUIDS, *Loss of*, Phosphorus, phosphoric a.
GRIEF, Cimicifuga.
INJURY, Arnica, conium, plantago.
LACTATION, *Excessive*, Phytolacca.
MERCURY, *Abuse of*, Hepar s., nitric acid.
MILK, *Obstruction to the flow of*, Cistus c., graphites.
NURSING, Belladonna.
PREGNANCY, Sepia.
SEXUAL ABUSE, Phosphoric a.
SYPHILIS, Kreosotum, mercurius, nitric acid.
WEANING, Rhus tox.
WET, *Getting*, Rhus tox.

XIII. CONSTITUTION AND TEMPERAMENT.

CACHECTIC, Secale c.
EYES, *Blue*, Bromine, phosphorus.
Dark, Iodum.
HAIR, *Light*, Bromine, phosphorus.
HYSTERICAL, Conium, ignatia, lachesis, nux m., pusatilla, sepia.
LEUCOPHLEGMATIC, Calcarea c.
PLETHORIC, Aconitum.
SCROFULOUS, Calcarea c., cistus, sulphur.
SLENDER *women*, Phosphorus.
SYPHILIS, Kreosotum, mercurius, nitric acid.
THIN, *scrawny women*, Secale c.
UNMARRIED WOMEN, Conium m.

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ERRATA.

Page	25,	line	26,	read,	" muscles, nerves, etc.
"	25,	"	31,	"	" Haversian."
"	50,	"	5,	"	" mare and ass."
"	65,	"	1,	"	" the nuclear, etc."
"	98,	"	25,	"	" embryonic."
"	105,	"	30,	"	" heterotopia."
"	124,	"	33,	"	" asexual."
"	125,	"	15,	"	" asexual."
"	177,	"	25,	"	" a, hypertrophy, etc."
"	177,	"	27,	"	" *b*, Diffuse, etc."
"	177,	"	29,	"	" *c*, Circumscribed, etc."
"	177,	"	31,	"	" *d*, Hypertrophy, etc."
"	177,	"	33,	"	" a, Hypertrophy, etc."
"	182,	"	38,	"	" squirre."
"	190,	"	2,	"	" displacement."
"	198,	"	12,	"	" very."